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The Essex Naturalist:

BEING THE

JOURNAL

OF THE

ESSEX FIELD CLUB.

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,

Honorary Secretary and Curator.

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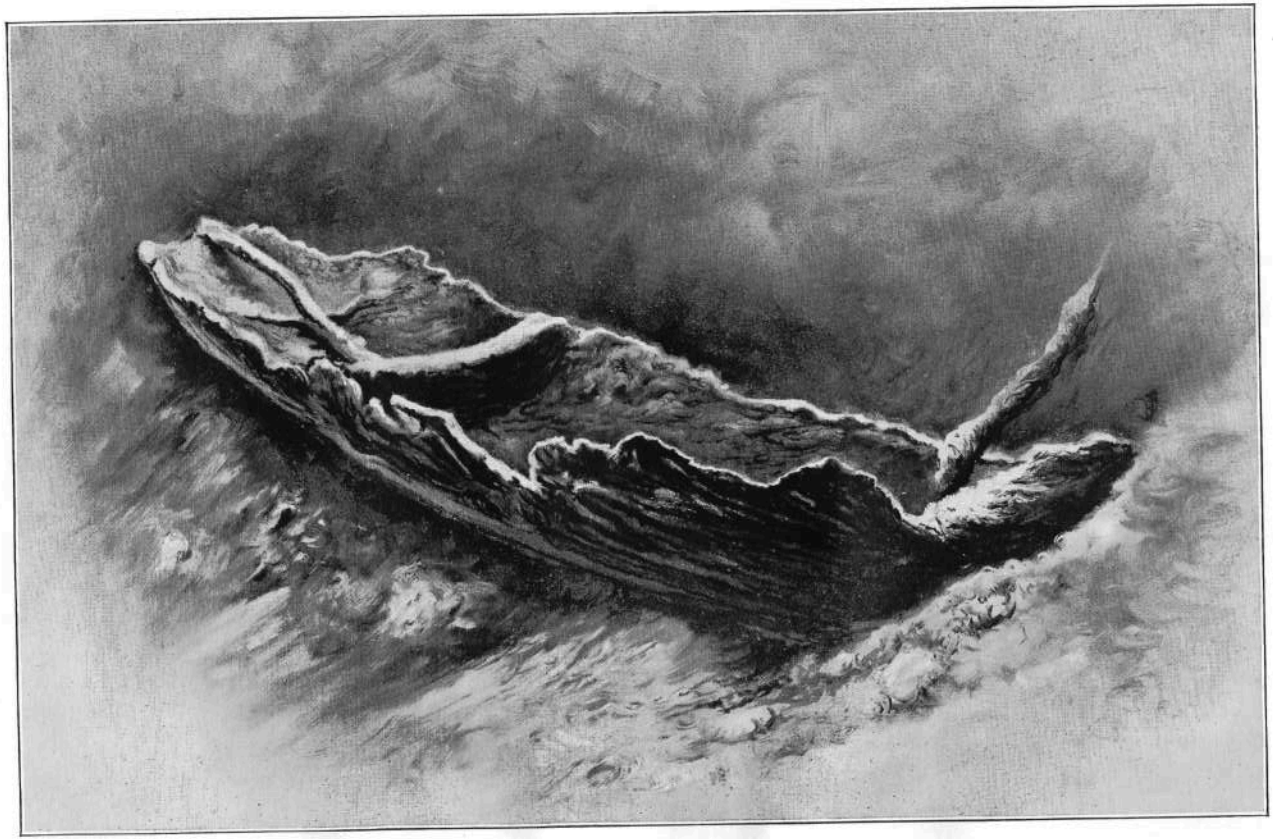


Dug-out Boat *in situ* **at Excavations at Walthamstow.**

Drawn by Mr. H. A. Cole,
from Photograph furnished by Mr. C. W. Sharrock.

THE

ESSEX NATURALIST:

BEING THE

Journal of the Essex Field Club,

(VOLUME XII.)

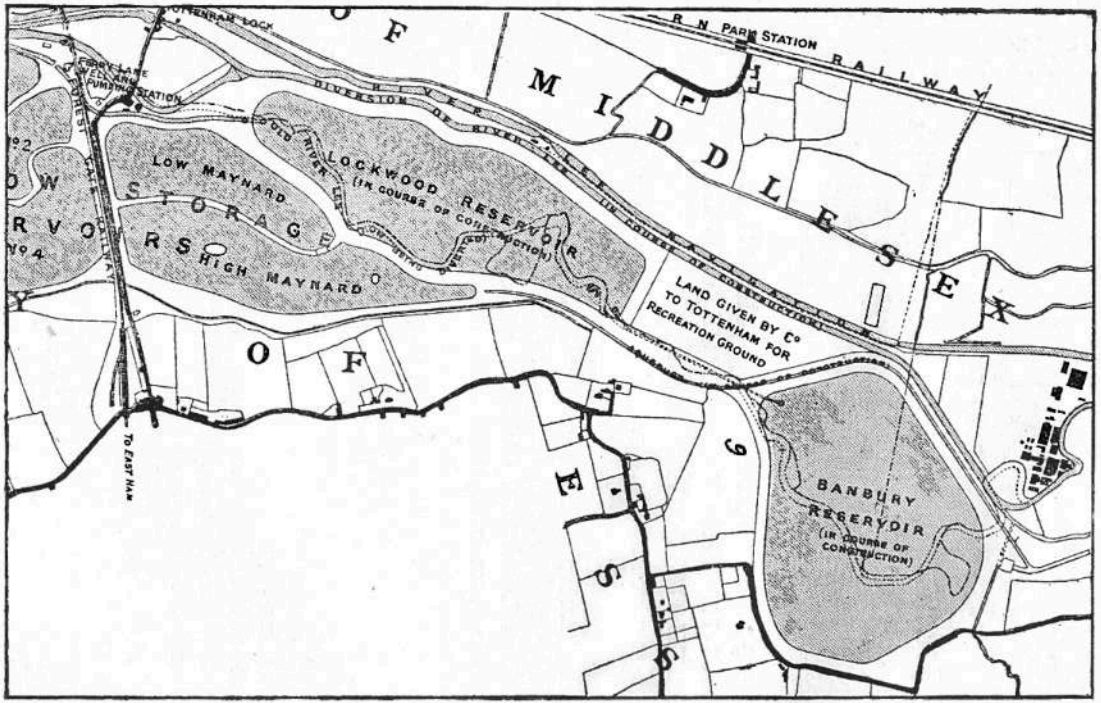
GEOLOGICAL NOTES ON THE NEW RESERVOIRS IN THE VALLEY OF THE LEA, NEAR WALTHAMSTOW, ESSEX.

By T. V. HOLMES, F.G.S., F. ANTHROP-INST. ; *Vice-President E.F.C.*

[*Received April 25th, 1901.*]

These reservoirs, the excavations for which have been in progress for more than a year and are still proceeding, are in the Valley of the Lea west of Walthamstow and east of Tottenham, and are being executed for the East London Water Company by Messrs. S. Pearson and Sons. The more northerly, which will be known as the Banbury Reservoir, occupies the marsh between Higham Hill and the outfall of the Ching; the more southerly is south west of Higham Hill and east of Stonebridge Lock. The words "Mitchley Marsh" appear on the Ordnance Map (6in. to the mile) towards its southern end. Two older reservoirs, known as the Low and High Maynard, lie east or south-east of this new "Lockwood" Reservoir. All are north of the road connecting Tottenham Hale and Blackhorse Road railway stations. (See Plan).

Before touching upon the nature of the beds seen in the reservoir excavations, it may be useful to say a few words on the general geological structure of the locality. The oldest formation visible is the London Clay, which underlies the marshes in the Lea Valley and appears in the higher ground on each side. Patches of gravel and loam, fragments of old river deposits formed when the existing streams, not having eroded their



Plan of the two new Reservoirs, near Walthamstow, showing Course of the old River Lea. *g*. Gravel; *s*. Position of "Viking" Ship. The position of the Dug-out boat was near the western side of the Southern Reservoir, and south-west of the "Viking" Ship.

valleys to their present depth, were flowing at some higher level, often cap the London Clay at various heights. The lowest and most recent of these river-deposits are those forming the marshes bordering the Lea, in which the new reservoirs are being excavated. Other gravel patches, which may be seen here and there a few miles from the reservoirs, usually at greater heights than the highest of the deposits mentioned, being unconnected with any existing river system do not here concern us.

In the immediate neighbourhood of the new reservoirs, a good example of the fragment of an old river deposit may be seen on the northern slope of Higham Hill, about 150 yards south-east of Higham Hill Ferry, and the same distance from the southern edge of the more northerly of the two new reservoirs. West of the Lea, the high road between Tottenham and Edmonton is on old river gravel of less age and elevation than that of Higham Hill. And while no bare London Clay is anywhere visible between the marshes of the Lea and the slightly older and more elevated gravel of Tottenham and Edmonton, there is a distinct belt of London Clay between the marsh in which Banbury Reservoir is being excavated, and the gravel and loam capping the northern edge of Higham Hill.

Another point of distinction between the gravel and loam of Higham Hill, and of Walthamstow generally, and that of Edmonton and Tottenham lies in the fact that they appear to belong to two different rivers, the first-named to the Thames, the latter to the Lea. At the present day we naturally consider ourselves in the valley of the Lea four or five miles south of Higham Hill. But examination of the Geological Survey Map of the district showing the distribution of the river-deposits makes it evident that the Thames, at one time, both above and below London, took its course some miles north of its present channel. And that the gravel of Stamford Hill, Higham Hill, and Walthamstow was formed in all probability by the Thames, when flowing in ancient times in a more northerly and a more elevated channel than it now does.

Before descending from Higham Hill to the Marshes in which the reservoirs are being excavated it may be well to note the nature of the more ancient river-deposits capping the hill. They consist of gravel covered more or less irregularly by loam,

as shown in a gravel pit, from 8 to 10 feet deep and from 30 to 40 yards broad, in the beds lying above the London Clay at the top of the hill. The gravel is largely subangular, and resembles in its general character that of the marshes below. And the loamy material by which it is more or less covered is evidently

Fig. 1. Higham Hill Gravel, &c. Height of Section 6ft; length 20ft.

the equivalent of that which forms the surface bed in the reservoir excavations. (Fig. 1). But the Higham Hill deposits are shown only in an ordinary gravel pit. While the gravel, loam, &c., in the area occupied by the reservoirs, have been displayed in sections hundreds of yards in length and ranging in every direction. Consequently the latter gave not only exceptionally good opportunities for noting variations in details, but their length, and the changes in their direction, combined to throw much light on the local changes of conditions to which the variations in the nature and thicknesses of the beds were due. An additional advantage which they possessed, of an exceptional kind, lay in their cutting across a deserted channel of the Lea. Then, while the largest gravel pits or brickyards usually show

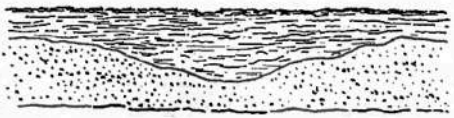


Fig. 1*a*. Higham Hill Gravel, &c. Height of Section, 8ft., length, 30ft.

clear sections over but a fraction of their total expanse, the reservoir excavations were almost everywhere fresh and distinct, and they were free from the sloping which is so geologically pernicious in the case of new railway cuttings.

The depth from the surface of the sections in the reservoir excavations varied from about 9 to 11 feet. They always showed loam or clayey loam at the surface and gravel at the bottom, though the thicknesses of the two beds varied considerably. In one place, for perhaps 150 to 200 yards or more, gravel, capped by from 1ft. 6in. to 2ft. of loam and soil, constituted the whole

section. Elsewhere the proportions of the two would vary extremely in the course of 20 yards or less, as in Fig. 2. Sometimes the loam towards its base became very dark and peat-like in appearance, and its line of junction with the underlying gravel very irregular, as in Fig. 3. Occasionally, between the gravel and the surface loam, a thin irregular bed of shellmarl appeared, or a definite bed of peat, formed of the remains of water or marsh plants, as in Fig. 4. Again, at about the level of a bed of peat of the kind just mentioned, formed of the remains of plants which had grown and decayed where the peat is now seen, tree and plant remains which had been deposited under totally different circumstances were occasionally visible in irregular bands towards the top of the gravel, as in Fig. 5.

The shell marl was usually in thin, irregular, lenticular bands, seldom exceeding 1ft. 6in. anywhere in thickness, and

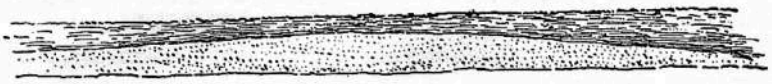


Fig. 2. New Reservoirs, Walthamstow. Height of Section about 9 ft., length about 50 yds.

disappearing in the course of 20 or 30 yards, as in Fig. 4. But at one spot near the outfall of the Ching the section consisted of

	ft.	in.
Soil	1	6
Sand and loam with many shells	4	6
Gravel		

The shells were those usually making up the shell marl.

At another spot the beds were—

	ft.	in.
Clayey loam, a little shell marl towards the bottom	3	0
Gravel		

At a third place was seen—

	ft.	in.
Soil and clay	4	0
Shell marl	1	3
Peat	1	6
Gravel		

In this case the shell marl retained the above thickness for a horizontal space of about 3ft., the whole band disappearing in less than twenty yards.

At another spot appeared—

	ft.	in.
Clay, darkening downwards, with a little shell marl at its base	3	0
Gravel		

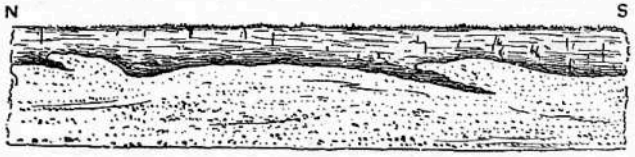


Fig. 3. New Reservoirs. Section towards S. end of Mitchley Marsh, seen July, 6th, 1900. Showing Clay, darkening towards the bottom, above gravel. Height of Section about 10ft., length about 50ft.

In some places there was nothing that could be called peat, and there were no traces of shell marl, though the thickness of the beds above the gravel was above the average, as in the two sections given below :—

	ft.	in.
Clay, darkening downwards	4	0
Dark soil	1	0
Gravel and sand		
And		
Loamy clay	3	0
Dark clay	2	6
Gravel		

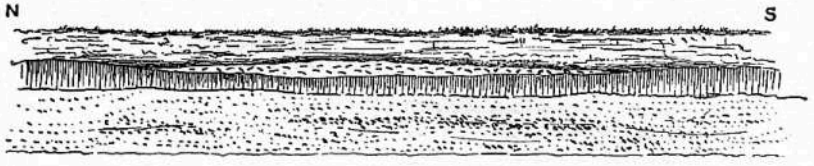
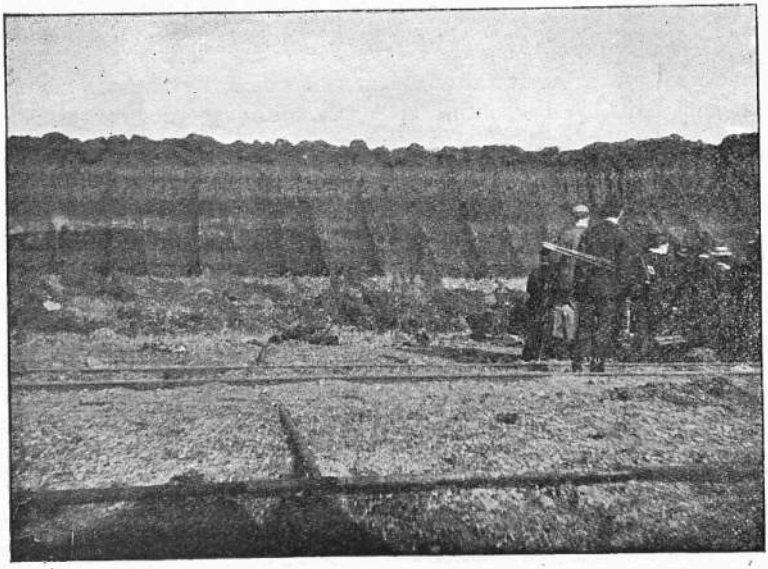


Fig. 4. New Reservoirs. Section about 100yds. N. of No. 1. Showing lenticular bed of Shell marl resting on Peat, and covered by the Clay forming the surface. Gravel at the base.

London Clay did not appear in the ordinary sections of 10 or 11 feet from the surface, which all ended in gravel, but it was usually visible at very slightly greater depths in trenches, &c.

An interesting feature in the marshes has been the presence of a disused channel of the Lea, which is partly included within the boundaries of the southern and partly within those of the northern reservoir. Towards the north-eastern corner of the southern reservoir at the spot marked (s) were found the remains of the old vessel described in the newspapers at the time of its discovery as a "Viking ship." It was seen on excavating from the old channel of the Lea a few feet southward, and had, doubtless, sunk in the then existing channel, which has since, possibly



Photograph of Section in New Reservoirs. Taken by Mr. F. Meeson during the visit of the Geologists' Association in April, 1901.

in consequence of the presence of the obstruction, been deflected a few feet towards the north. Another excavation made at this spot from the old channel northward showed that the channel had there, in more or less recent times, been deflected southward. This was demonstrated by the presence of fine gravel and sand containing irregular deposits of shells and vegetable remains, which were banked against 6 feet or more of ordinary alluvial clay, as shown in Fig. 6. Where this disused channel took a fairly straight course, the gravel in it was often diffused

pretty evenly, so that the stream must have been of nearly the same depth everywhere. But where there were many bends the gravel tended to become piled on one side. Thus, a few yards westward of the Viking ship, the gravel was seen to be piled on the more southerly side of the channel to within 3ft. of the top, the opposite bank showing

Loam	3ft.
Peat, earth with mud, and here and there shell layers	5 to 6ft.
Gravel	

Again, fifty or sixty yards further westward the gravel was heaped up against the more northerly side of the channel.

South-west of the place where the Viking ship was found, and a few yards eastward of the spot at which the channel made a sharp bend to the south, the "steam navvy" cut away the ground so as to expose a long section ranging nearly north and south and crossing the old channel nearly at right angles to its course there. In Fig. 5 this section is shown for a distance of

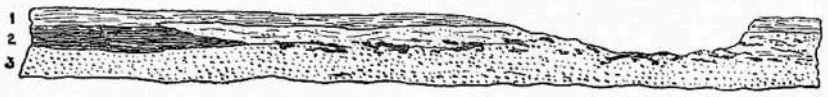


Fig. 5. New Reservoirs. 1. Surface Loam; 2. Peat; 3. Gravel and Sand. The irregular dark patches are fragments of the Stems of trees and plants, with other vegetable matter.

about 50 yards; the spectator is looking eastward, and the disused channel appears towards the southern end of the section. Throughout there was gravel towards the base and loam at the surface each retaining the same character throughout the section. But the intermediate beds varied extremely. At the northern end of the section there was a comparatively thick bed of peat formed of the remains of water and marsh plants which had grown in situ. About 10 yards from the northern end it was found, as shown in Fig. 5, that the peat bed had been eroded away and that in its place were gravel and sand more irregular in stratification than that towards the base of the section. And in this gravel and sand were irregular deposits of blackened vegetable remains, from tree stems to a *débris* of twigs, leaves, &c., which had been heaped confusedly together, just as they

appeared at the surface in the bottom of the old channel shown towards the southern end of Fig. 5. A few yards beyond the southern limits of Fig. 5 the section resembled that seen at its northern end.

I do not propose to say anything here about the fossil remains found in these reservoir excavations as a list of mammalian or molluscan genera and species, or to touch upon them in any way except so far as they may tend to throw light on various questions connected with the deposition of the beds and their relations to each other. Judging from the great variety of views which have been expressed by geologists of more or less eminence as regards river deposits of somewhat greater age, it seems desirable to point out the bearing on those questions of the evidence of these more recent beds. For light may fairly be expected from an appeal from the more obscure and fragmentary remains of the older river deposits to the fuller and more com-

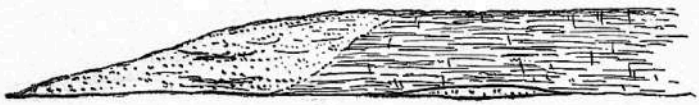


Fig. 6. New Reservoirs. Section from the Old Channel of the Lea northward, near the spot where the ship was found. October 1st, 1900.

plete evidence of the newer. It is true that in very recent times rivers like the Thames and Lea have been canalized more or less, and that, consequently, floods and specially high tides no longer deposit mud on the marshes adjacent to the streams as in more ancient days. But in the present case we have, on the other hand, the very unusual advantage of being able to inspect an old disused channel, which would be impossible but for the canalization of the stream for navigation. And, as I have already remarked, the length and varied direction of the sections shown in these reservoirs have given almost unique opportunities of noting the nature and variations of the strata and the way in which changes occur. As we have seen, the constant constituents of any section are the loam or clayey loam at the surface and the gravel towards the base. Their respective thicknesses may vary, but where they only are present the gravel always makes a larger proportion of the whole section than where peat,

or more or less peaty clay or mud, with shell marl, intervene between them. And it seems clear to me that the gravel has always been brought down in the channel of the stream; and that the surface loam is the mud which has been deposited on the surface during floods and very high tides. Where, between the gravel and the loam, there is a considerable thickness of peat, the plants, the remains of which compose it, having grown in situ, there shallow backwaters must have existed in which the plants grew. On the other hand, the irregular masses of vegetable matter mixed more or less with gravel and sand have evidently been brought down a channel, mainly in time of flood. And the little land and fresh-water mollusca, composing the shell marl, flourished either in backwaters or in shallow parts of a main stream where sand or mud were being deposited close to one bank, while that on the opposite side was suffering from erosion. The steady continuance of a state of things of this kind, at any one spot, for many years, would bring into existence a band of shell marl having a breadth corresponding to the lateral deflection of the channel of the stream.

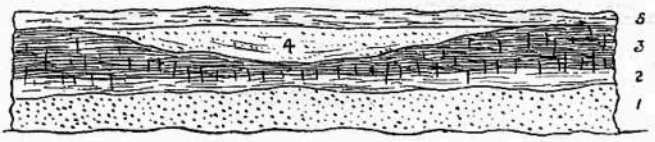


Fig. 7. New Reservoirs. Section of Minor Channel in Southern Reservoir (1901). 1. Gravel; 2. Mud; 3. Peat, with many Plant-stems; 4. Sand with Shells in channel; 5. Surface Loam. Height of Section, 10 to 11 ft.; length, about 18 yards.

The section across the old channel, shown in Fig. 5, illustrates my remark that the constant constituents of a section are the gravel towards the base and the loam at the surface. Taking the height of the section as 10ft., then the changes are all in the 5ft., or thereabouts, of beds in the middle part; the gravel towards the base and the loam at the surface remain unaltered throughout. This is especially noteworthy in the case of the loam, and clearly indicates that it is a deposit resulting from a general cause which, like a flood, would affect a whole river valley. It would consequently not be affected by the local character of the beds on which it rested, and would tend to equalise the surface levels, as we know it does.

Then, the section shown in Fig. 5 illustrates the way in which sections in river deposits may show fossil remains of very different ages at the same depth below the surface and only a few feet apart from each other. They may be also in the same kind of material. For a human relic or mammalian bone found at the top of the gravel underlying the peat at the northern end of the section might have been deposited many centuries earlier than some similar object, at the same depth from the surface, and also in the gravel, but found midway between the end of the peat and the channel. The object under the peat might have been deposited there in pre-Roman times; that twenty yards or less southward might belong to the eighteenth century or later. For the changes in the position of the old channel, which have caused the destruction of the peat and its replacement by sand and gravel containing irregular seams of vegetable matter, might have occurred at any subsequent time.

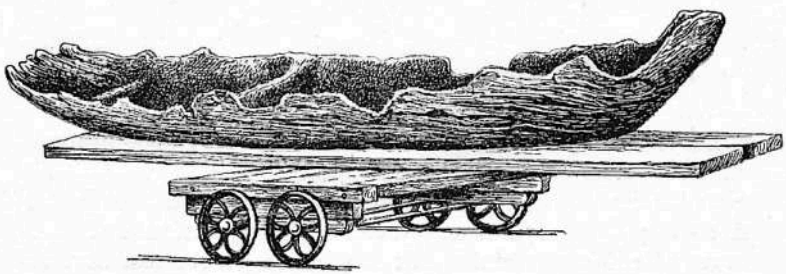


Fig. 8. Dug-out Boat found in the Walthamstow Reservoir Excavations, on trolly for removal. Drawn by Mr. H. A. Cole. For drawing of the boat *in situ*, see Frontispiece to the present volume.

I have already mentioned the discovery of the old vessel, generally supposed to be a Viking ship, near the old channel. But some distance to the south-west, in the excavations for the same reservoir, a boat of much more ancient character was found. This was an ancient British "Dug-out" canoe, of the kind so common in ancient lake dwellings. Mr. W. Traill, one of the engineers superintending the excavations, was fortunately able to get it out almost entire, and it is now carefully preserved. From an account which Mr. Traill has given of the canoe in *The Reliquary and Illustrated Archæologist* for January, 1901, I take the following details:—

"It was resting on a bed (5ins. thick) of fine sandy silt-mixed with fresh water shells. . . . The geological section is as follows:—Soil, 1ft.: clay, 2ft. 6in.; clay and gravel, mixed with vegetable matter, 1ft. 3in.; gravel, 1ft. 3in.; sandy silt, 5in.; gravel."

I had the good fortune to see the canoe and the place at which it was found, in the company of Messrs. W. and H. Cole, and under the guidance of Mr. Traill, a few days after its discovery. (See Frontispiece to present volume). Mr. Traill remarks that the canoe seems to have been drawn up on the bank of an old river. Probably it had been lying in the shallow part of the old channel when a sudden flood had carried it down and deposited it where it had become entangled in vegetable *débris*, had sunk and become silted up. It may be noticed that the section given by Mr. Traill much resembles that near the disused channel in Fig. 5. As these ancient dug-out canoes vary very much in size, it may be worth adding that this one was 14ft. 10in. long, 2ft. 4in. broad, and 1ft. 4in. deep, taking the extreme measurements in each case. (Fig. 8.)

Munro, in *The Lake Dwellings of Europe*, remarks that the intimate association of these dug-out canoes with lake-dwellings has been noted both in the British Isles and on the Continent. He adds that their discovery in lakes and bogs has been considered by Dr. Stuart as an indication of the existence of crannogs. Dr. Munro thinks that the period of greatest development of the Scottish and Irish Lake-dwellings was during the pre-Roman Iron Age, but points out that neither the use of lake-dwellings nor that of dug-out canoes is necessarily prehistoric. In the case of this Lea dug-out, Mr. Traill remarks that "several pieces of Roman pottery and a well-made iron spear-head have been found at points ranging from fifty to a hundred yards from where the dug-out was lying, and in practically the same stratum." But this, though an interesting fact, by no means—as we have seen—involves a similar antiquity for the dug-out.

Just as the Glacial Period doubtless came practically to an end in South-Eastern Britain many centuries before the climate had materially changed in Northern Scotland, so dug-out canoes must have been in use in the wilder parts of the British Isles long after they had become extinct on the Thames and Lea.

Besides the exceptional facilities for intercourse with the Continent possessed by the inhabitants of this district generally, waterways like the Thames and Lea gave special facilities, two thousand years ago, for local intercommunication, facilities of enormously greater relative importance than they now afford. And the sites of Tottenham, Edmonton, and of old London are such as must have recommended themselves to the earliest settlers in permanent towns or villages, from the water supply obtainable from the gravels on which their houses stand, as well as from their proximity to the rivers. In short this district must have been one in which dug-out canoes became extinct sooner than in any other part of the British Isles. Nor would they be likely to survive even as the coracle of the Severn has done. For, though primitive, the latter is extremely portable, while the dug-out must have been more ponderous than the least advanced of more modern craft, and have had no counter-balancing advantage of any kind. Now the explorer Pytheas, about the year 330 B.C., found that there was then considerable intercourse between South-Eastern Britain and the Continent, though the intercourse was confined to this part of the British Isles, which he found abounding in corn, and affording every evidence of a settled agricultural condition.

Among the human relics should be mentioned, in addition to the dug-out and the Viking ship, a considerable number of tobacco pipes. Those I have found myself were mostly towards the base of the surface loam, but some were in the sand of a disused channel. They are not all alike as regards shape, but most of them appear to resemble the pipes of the seventeenth and eighteenth centuries, rather than those of a later date.

In short, the articles used by man found in these recent river deposits date from perhaps B.C. 500 to the present day. For its seems to me that the available evidence makes the dug-out's date here suggested more likely to be insufficient than excessive. Then the Roman pottery, &c., mentioned by Mr. Traill will be by some six or seven hundred years more recent. The Viking ship is not unlikely to have been one of the Danish fleet which went up the Lea in A.D. 895, were blockaded there by King Alfred and captured or destroyed in the following year, as narrated in the Anglo-Saxon Chronicle.[1] And the pipes, as already mentioned, vary in age from the 17th century to much more recent times.

1 Supposing that fuller examination confirms the view that it is a Viking Ship.

However, my object is not to give a list even of the human relics found in the excavations, but only to allude to them so far as may be necessary to illustrate the formation of these recent river-deposits, and consequently that of those which are older and more obscure. Where a river has cut its way through comparatively hard rocks, it may leave terraces clear enough to be traceable for a considerable distance marking its former position. But this is not the case where the river's course, as in South Essex, has been through a formation like London Clay. Then, as we know, it may be possible to note a broad flat composed of river-deposits which rises very gently northward, but it is impossible to trace a distinct terrace except for a few yards here and there. As in a river-deposit the Mollusca usually vary but little, it has naturally happened that geologists examining sections in the older and more obscure fluviatile beds have often dwelt mainly on the human relics or mammalian remains as the chief guide to their relative antiquity, and have disregarded the stratigraphical evidence. For illustrations of the extraordinary differences of opinion as to the older river-deposits of the Thames, and the relative antiquity of various members of the series which have thence resulted, see the chapter on the literature of the River Drift in Mr. Whitaker's memoir on *The Geology of London and of Part of the Thames Valley*, Vol. I., pp. 328-387.

Now in the case of these reservoir sections there can be no controversy about their stratigraphical position. No one can assert that the beds at one spot in either reservoir belong to an older series than those elsewhere simply because a pre-Roman dug-out canoe has been found here, and tobacco pipes only there, at the same level. The excellent sections, long but varying in direction, have illustrated, as no other sections could have done so well, how incessantly a river in its windings tends to change its course, and yet how often a spot a few yards from a recent or existing channel may have remained unmodified for centuries. And consequently it becomes evident that in older river-deposits there can be no legitimate excuse for assuming stratigraphical changes not only unsupported by, but contrary to, the available stratigraphical evidence, to account for apparent discrepancies in the nature of the fossil evidence analogous to those presented by the human relics found in the marshes of the Lea. In the absence of evidence like that furnished by these reservoir excava-

tions, changes such as have been so amply demonstrated there come to be looked upon as mere abstract possibilities which may safely be disregarded in practice.

APPENDIX I.

Lake-Dwellings in the Lea Marshes.

I have mentioned that a close association between the existence of dug-out canoes and that of primitive lake-dwellings has been observed. Of course there is no necessary connection between them, and in all probability there was never anything that could be called a lake in the Lea Valley from Broxbourne southward. But there were probably on the Lea marshes, in primitive times, houses of the kind mentioned by Munro in *The Lake Dwellings of Europe*, p. 553. He says :—

"A reference to Lake Dwellings occurs in a passage by Hippocrates (*De Eribus*, &c. XXXVII) :—'Concerning the people of the Phasis, that region is marshy and hot, and full of water and woody; . . . . The inhabitants live in the marshes and have houses of timber and of reeds constructed in the midst of the waters ; and they seldom go out to the city or the market, but sail up and down in boats made out of a solid tree trunk, for there are numerous canals in that region' [This locality is east of the Black Sea.]"

The sections displayed in the reservoir excavations show frequent changes in the main channel of the Lea, and suggest the existence of many backwaters, or partly deserted channels, in which water-loving plants grew, leaving beds more or less peaty for our inspection to-day. The Lea Marshes would therefore afford many positions either wholly surrounded by water or easily made insular, as sites for pile dwellings. As when (for example) we traverse the hilly parts of the Chalk, and seldom, if ever, find a naturally strong site unoccupied by an ancient camp of refuge, so we may fairly conclude that eligible sites on marshes for pile-dwellings would not, in primitive times, remain unused. To come to a later period than that of dug-out canoes, we find the Lea shown, in Norden's Map of Essex (1594) as having two or more channels of apparently equal importance all the way from Broxbourne to Blackwall, the other rivers marked on the map having but one channel, except that the Thames, as at the present day, has many around Canvey Island.

It seems therefore highly probable that the pre-Roman users of dug-out canoes on the Lea lived in pile-dwellings on the

marshes, which were unusually favourable to such habitations. In mediæval and later times the marshes were deserted, and the inhabitants of the river valley lived on older river deposits above the reach of floods, and obtained their water supply from the lower beds of the gravel on which their houses stood. And in the case of isolated dwellings, protection from robbers was obtained by the digging of a moat around the premises which was supplied with water from the same source. Moated houses of this kind are not uncommon in southern Essex and elsewhere, though at the present day the moats are often more or less filled up.

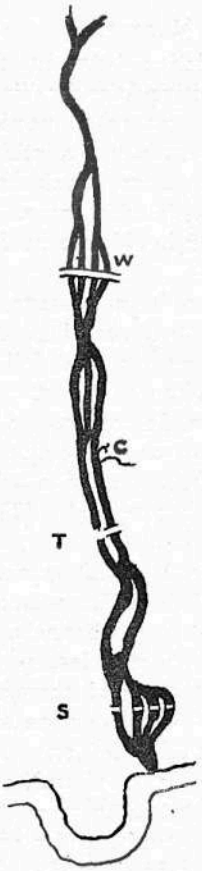


Fig. 9. The River Lea, from its junction with the Stort southward, as shown on Norden's Map of Essex (1594). W, Waltham; C, Outfall of the Ching; T, Tottenham; S, Stratford.

APPENDIX II.

Channels of the River Lea.

Though Norden's Map of Essex (1594), shows the Lee with two or three channels from Waltham Abbey to its outfall into the Thames, the map of Beacontree Hundred and the adjacent parts of South-west Essex in Morant's *History of Essex* (1768), reveals but one channel below Waltham Abbey. Of Waltham Morant remarks:—"Waltham is the most considerable place in this Half Hundred, to which it gives its name, and also to part of the Forest of Essex. . . 'Tis situated near the river Ley, where its parting into several streams, forms divers little islands."

Both the above-mentioned maps are doubtless trustworthy in their record of the number of channels locally existing in their respective periods, though without claims to minute accuracy as regards the shape of some island enclosed by the streams, or other points of that kind.

[Both Mr. Holmes and the Secretary desire to record their grateful thanks to Mr. Sharrock, Messrs. S. Pearson & Son's representative at the works, to Col. Byan, the Engineer to the East London Water Company, and to Mr. Traill and Mr. Marsh, Assistant Engineers, for much kind aid and sympathy during the numerous visits made to the works.—Ed.]

ON THE VARIATIONS IN NUMBERS AND HABITAT OF MARINE ANIMALS ON THE COAST OF ESSEX DURING THE LAST TEN OR TWELVE YEARS.

By H. C. SORBY, L.L.D., F.R.S. F.L.S. &c

During the last ten or twelve years I have spent a good deal of time in collecting marine animals along the coast, and in the estuaries, of Essex and the adjoining parts of Suffolk, as they were floating near the surface or by using a dredge or small trawl, or by examining the mud or shores exposed at low water; but paying little attention to such as are less than $\frac{1}{2}$-inch in length. In doing this, I have been much struck by the great variations that have occurred from year to year, and with the remarkable contrast between what I now find in some localities, and what I found 10 or 12 years ago, or even more recently. Some of the changes may be, and probably are, of a temporary character, and the original conditions may be restored in years to come; but some seem as if likely to be permanent. In the earlier years I did not expect to be in the district so long and so continuously, and never anticipated that I should witness any striking changes, and so unfortunately I omitted to take such detailed notes as would now have been very valuable. It was only by degrees that the great extent of the changes became apparent. In any case it now appears to me desirable to put some of the facts on record, since they may be of much interest in years to come.

I have not noticed any material change in the number of some animals. Of these I may mention the Common Shore Crab (*Carcinus mænas*), the Hermit Crab (*Pagurus bernhardus*), the common *Nereis* (*N. versicola*), *Nepthys hombergii*, *Arenicola marina*, *Sabella pavonia*, *Lanice conchilega*, *Cirratulus cirratus*, *Doris pilosa*, *Echinus miliaris*, *Solaster papposus*, *Asterias rubens*, *Ophiura texturata*, *Ophiothrix fragilis*, and several species of simple and compound Ascidians, such as *Ascidiella virginea* and *aspersa*, *Ciona intestinalis*, *Cione grossularia*, *Molgula arenosa*, *Botrylloides rubrum* and *leachii* and *Botryllus schlosseri* and *polyclyclus*.

There has, however, been a great change in the case of some other animals. I do not take into account such as are so rare that very few specimens have been seen, since in such cases too

much depends on accident; nor would it be fair to take particular notice of what I have seen in places not visited repeatedly.

I think that some great changes were due to the very severe winters experienced a few years ago. For example, the number of living individuals of the common *Cardium edule* previously found near the mouth of the Crouch was very great; after the severe winter of 1894, which killed so many oysters, few could be found alive, but an enormous number of dead shells were seen. Also, previously, very fine specimens of the Gephyrian, *Priapulus caudatus*, could be obtained from the mud of the Deben near Waldringfield, but afterwards only comparatively small individuals, as though the larger had been killed. It, however, seems doubtful if this explanation will suffice in places where the water is always tolerably deep As an example, I may say that eight or ten years ago, in that part of the Deben, near Ramsholt, called the Rocks, I was able to collect by dredging fairly numerous fine specimens of the beautiful purple Nudibranch, *Eolis coronata*, but latterly I have not been able to obtain them, though most anxious to do so. They have also become more rare in other localities where I used to find them, as for example in the Orwell at Pin Mill, and off Mersea, in what may be looked upon an almost open sea.

It seems difficult to understand what can have occurred to influence such a large mass of sea water as in the Stour below and above Harwich, but yet I have remarked considerable changes during the last 10 or 12 years. I then found sundry Nudibranchs, which I have not obtained for years and the curious worm, *Aphrodita aculeata*, has become much more rare. Good small specimens of *Loligo media* were fairly common, but latterly they have become more and more scarce. Both there and in every locality in which I have trawled, the number of specimens of *Sepiola atlantica* has also become less and less, year after year, and, instead of catching dozens, I got only an odd one now and then. What may possibly have been a distinct small species of *Sabella* was at one time abundant in the Pye-fleet by Mersea, but I have not seen it for some years. On the contrary in 1899 I caught off Mersea some half score of what are probable the young specimens of *Sepia officinalis*, not one of which I had caught before anywhere along the coast. In some of the

later years I have found one or two other animals I had never seen before in the district.

In considering this question it is, however, impossible to be sure that certain of the apparent changes are not due to the remarkably local distribution of some animals, and it is possible that the exact locality where they abound may shift somewhat from year to year, owing to a partial migration. As bearing on this subject, I may say that certain animals are very numerous in one particular place, though I have met with very few or none anywhere else over a wide district. In some cases this may fairly be attributed to the very peculiar conditions under which they are found. For example, I never saw a single individual of a *Phascolosoma* (not yet identified) until in 1899 I hit upon a particular locality near Brightlingsea where several specimens may be found in each spade-full of the sandy gravel. In 1900 and 1901 I examined this place more fully, and it seems to me that this unusual abundance in one part and absence elsewhere, close at hand, is due to the peculiar local conditions; since the *Phascolosomæ* seem to occur only where this sandy gravel is kept constantly soft by salt water draining out through it, when the tide is low, which occurs only in one part, at a particular level.

There is a locality in the Orwell, a short distance below Pin Mill, usually at about the level of half tide, but perhaps varying with the season, where a species *Synapta* occurs so abundantly that specimens may be collected out of the mud by dozens; and, yet, I do not remember seeing a single individual elsewhere along the coast. I cannot understand why this should be so, unless it be due to the percolation of a certain small amount of fresh water from the adjoining shore, which in this particular part is fringed with reeds. In 1901 I could not find a single specimen. In the Deben also, near Waldringfield, I have been able to collect in less than an hour more specimens of *Priapulus caudatus* than I could obtain in weeks in any other place along the coast; and yet I cannot even suggest a reason for this, since there do not appear to be any conditions not met with in many other localities.

So far most of the animals referred to are more or less fixed, or probably do not move far, but there seems to be an equally great variation in those which, like Medusæ, float with the tide

over great distances. In such cases it is not a question of occasional inspection or of looking for them or dredging, since they are visible at any time in suitable weather from the deck of the yacht, when they are present. There seems to be great variation in the numbers of the very common Medusa, *Aurelia aurita*, in different years, unless it be that in some years they swim near the top and in others low down out of sight. This they certainly do according to the weather, coming towards the top when fine and smooth, but such a difference could scarcely occur throughout an entire season. In July, 1888, I saw in the course of a few days in the Alde below Orford, more deep blue specimens of *Cyanea lamarkii* than I have seen anywhere before or since, though year by year I have looked for them most attentively and not seen one. This handsome species had not been previously observed within some hundreds of miles of the English coast. Many years ago I saw at Queenborough a great many specimens of the beautiful Medusa, *Chrysaora isoceles*, but lately I have year after year seen comparatively very few. Last year (1900) I think they were somewhat more common ; but, strange to say, they were all a very pale variety, with none of the dark radiating stripes on the upper surface. In the last few years good fine specimens of *Pleurobranchia pileus* have been more and more scarce, whereas formerly they were common. Time alone will show whether such changes as these just described are permanent or only temporary. The great variation in the numbers of fish and shrimps is, of course, well known.

Of a totally different character is the remarkable occasional appearance of *Heteronereis*. I have never found specimens in mud, but in dredging I have obtained a few, very imperfectly developed. I have occasionally found them in my aquarium, into which they must have been introduced when young, living in tubes amongst algæ, before assuming the adult form. The remarkable fact is the manner in which they are now and then seen swimming at the surface of the sea water. I must have lived at anchor in the Orwell and Stour for a total period of between one and two years, and yet I never saw *Heteronereis* in that locality except off Harwich on July 16th, 1898, and perhaps once in the Orwell at Pin Mill. I do not know how early they appeared, but from the time I turned out at 5 a.m. until 7 a.m., they were swimming about on the surface in such numbers that they were only a few yards apart, and, as I judged over an area

of probably one or two square miles, so that the number may have been something like a million. They were apparently all males probably of the species *Nereis dumerilii*. Not one was seen the day before or the day after. Some years earlier at Queenborough, I saw on one evening a similar large number of a somewhat different kind of Annelid, larger and coloured much more red by hæmoglobin, which were both males and females, and though I most carefully looked for them that year and subsequently I never saw another. Once before I witnessed a similar display off Sheerness. It thus seems probable that these worms usually live in tubes which they build amongst algæ, and just occasionally, for a few hours, swim about on the surface in the *Heteronereis* condition, probably when scattering the ova or spermatozoa; the remarkable thing being that apparently all do so at the same time. It is impossible to say what occurs lower down out of sight, and the swimming at the surface probably to some extent depends on the weather being calm.

I must now describe a series of changes which seem more easy to understand than those already noticed. Until a few years ago the bottom of the Orwell at Pin Mill was almost entirely free from mud, and was to a large extent covered with Sponges, *Alcyonidium*, and compound Ascidians. The number of *Caprella linearis*, a small *Terebella* (*Nicolea zostericola*), and the curious worm, *Siphonostoma diplochaitos*, was astonishingly great; and a larger number of different species of animals could easily be obtained by dredging than in any other place along the coast. In 1898 and 1899 I however found the bottom covered with a fine tenacious mud, built into short, stout, soft tubes by enormous numbers of the small Amphipod, *Jassa pulchella*, which had increased so much as to have smothered and almost exterminated most of the animals previously living at the bottom. There had been little, if any, change in the mudbanks left dry at low water, nor any marked change in the animals living there. To my surprise I found the bottom clean in 1900, near Pin Mill, though lower down the bottom was more muddy than it used to be. In 1901 the bottom was clean and there was a most extraordinary number of small specimens of simple Ascidians, to the almost complete exclusion of other animals. Probably some of these changes have been due to the extensive dredging operations carried on to improve the navigation to Ipswich, and perhaps in a few years the original conditions may be restored.

After living on a yacht for some months, it is, of course, desirable to clean off the various animals and plants that have grown on the bottom. Sometimes I can then obtain specimens not otherwise easy to find. The most remarkable circumstance I have noticed is that in different years the animals attached to the bottom may be most strikingly different, though the yacht may have been at the same places, or very nearly so. One year the entire surface under water was covered with small *Balani*, growing as close to one another as they could; I estimate that the total number was something like two millions. Another year there were few *Balani*, but the bottom was covered with Ascidians of the genus *Ascidiella*. On other occasions the most striking form was *Tubularia larynx*, good specimens of which I have not been able to obtain in the district except from the bottom of the yacht. In 1899, after lying a long time at Pin Mill, the bottom was covered by soft, tenacious mud, built up by the small Amphipod, *Jassa pulchella*. On other occasions we have found variable mixtures of the above-named animals. These facts show what great variations there may be from year to year, which is thus so marked, because the bottom of the yacht is always clean to begin with, and animals attached one year cannot be mixed with those attached another year, as must often happen on rocks, and stones, and other natural objects.

It will thus be seen that, even in the short period of 10 or 12 years, many noteworthy changes have occurred, and, in some cases at all events, it seems doubtful if the original conditions will be restored in years to come. This is certainly indicated by the fact that in so many cases vast numbers of well preserved dead shells are met with *in situ* in places where the same species are seldom if ever met with alive. Taking all into account, it certainly appears to me that a considerable number of interesting animals have become more and more rare, whilst but few have become more abundant. The first explanation that suggests itself is that the changes may in some way have been due to human agency, like so many changes in animals and plants inland. In some localities an increase in the amount of sewage discharge may have been the cause; but, though in this respect the worst place I ever stayed at is the water at the back of Walton-on-Naze, yet I never saw a better collecting ground for numerous interesting animals. The use of artificial manures and gas lime may also have had considerable influence in some

localities. In some places the water is much more muddy than it used to be. Another probable cause of change in the estuaries is the improved draining of the land, which necessarily tends to increase the amount of fresh water at the time of floods. I have been told of a case in which such an event killed thousands of pounds worth of oysters, and this effect would explain why so many full grown shells of clams and other species are often seen farther up the rivers than living ones now occur. It is, however, very difficult to believe that this cause could operate in the case of comparatively open water. It is, of course, easy to understand that a permanent diminution of fish may have resulted from over fishing, and we may well believe that the great number of fish, shrimps, and star-fish caught, and the various operations of oyster culture, may materially affect the number of some other animals; since the inter-relations of those living together are probably sufficiently intimate to produce such an effect. We must also bear in mind possible cyclic changes in the weather, and the effect of a series of hot and cold, dry and wet years.

Though thus calling attention to various possible explanations of the facts I have described, I feel that they are little better than suggestions, and that possibly the final results may be due to the variable combined effect of many such temporary or permanent causes. It seems to me very desirable that those who have constantly studied other districts should record their experience, since that might throw far more light on the question, and eliminate various sources of error which beset this subject on all sides.

NOTE.—For the identification of the species named in this paper, I am to a great extent indebted to Mr. Walter Garstang, the Rev. T. R. R. Stebbing, F.R.S., and Professor Herdman, F.R.S., so that I believe they may be relied upon as correct.

ADDRESS DELIVERED AT THE 21st ANNUAL MEETING OF THE ESSEX FIELD CLUB, MARCH 30th, 1901.

By DAVID HOWARD, J.P., F.C.S., *President.*

In completing my term of office as President I must yet again congratulate the Club on the achievement of the long delayed purpose of establishing a Museum, alike to render permanent, and to spread more widely, the work of the Society. I need not go again over the history of that arduous, and at times seemingly hopeless, task, but would venture to remind our members that the real work is but begun; in museums, as in everything else, growth is the text of life, and without living progress, a Museum sinks into the fossil stage of existence and is best buried out of sight along with other fossils. Unfortunately we already find that we need more money to develop the work, and any who are willing to assist, may rest well assured that their money will be fruitfully expended under the care of our indefatigable Curator. We are already beginning to feel that *space*, and not the wherewithal to fill it, will be our difficulty, and that even the noble generosity of Mr. Passmore Edwards so freely supplemented by that of the Technical Education Committee of the Borough of West Ham, has given us none too much room for our museum work. Perhaps some will say, "there is no satisfying such people." It is quite true, and it is better so; in scientific as in some more important matters, the sense of fulfilment and satisfaction is a very dangerous one. I do not know that there is great need that I should impress this on most of those here; for which of us, even in those matters in which we have done most, and learned most, is under any delusion that he has exhausted the possibilities. But I would urge all to keep this truth in mind, and not to fail to impress it on those especially who having made less progress are less conscious how little progress they have made. And there is special danger in a too keen satisfaction in the work of greater minds who have preceeded us. A great teacher may even dwarf the minds of his pupils, by giving them an unconscious despair of progress, by the admiration they rightly feel for his work. It was not the profoundly scientific, if imperfect, teaching of Aristotle, but the fatal "ipse magister dixit" of the schoolmen, that dwarfed scientific

thought in the Middle Ages. They did not imitate their master in the study of nature; they contented themselves by studying *him*.

The danger is just as present with us as it was with them; there is so much to impress, delight, and satisfy us in the marvels of modern science, that perhaps all of us, most certainly the beginner, may easily allow the feeling to get the mastery, that there is nothing left to do, nothing even that needs doing.

And then in instructing others (and we all, if we know a little more of anything than those around us, cannot help doing that, even though we may never venture to count ourselves as teachers) it is tempting to human nature to dwell on how much we know, and but slightly on how little we know (which may be the more important of the two) and that is a lesson that finds too apt a pupil in a beginner.

It is one of the most hopeful elements in the best teaching of science, that such wise efforts are made to encourage the student to work out problems for himself. It is no easy matter; it is wonderful what pains the average boy will take to avoid thinking. He will perform the marvellous feat of learning a proposition of Euclid by heart, without understanding it, and he will go through life with two or three adjectives in his vocabulary which he uses with persistent inappropriateness to save himself the terrible trouble of thinking out what he means.

But even if we escape from these elementary forms of satisfaction, I am not sure that we have exhausted the dangers.

May I try to set before you two habits of mind which are not easy to define, for the words that seem naturally to explain them are themselves of such uncertain meaning (at any rate in common speech) that they need definition before we use them.

Idealism and realism, at any rate in their older senses, express the two modes in which one may regard scientific as well as other matters. One may dwell upon the general or on the particular, and I want to urge that the more idealism there is in our thought, the more one seeks for the general, the more progress one can make. It is easy to recognise a proposition of Euclid as true of the particular circles and triangles drawn on the black-board, but it is a distinct sign of progress to prove the proposition with the figures upside down; beyond that lies the

larger conception that it is true of all possible triangles, and further still that the truth lies in the very nature of a triangle. Such is the irony of fate that we really never really understand the case of the particular triangle, until we have grasped the *idea* (in the Platonic sense) of all triangles.

Now if this is true in the simplest forms of study, it is yet more true in the recondite. The ordinary definition of the ideal is "that which is not real"—which is true—but what do we mean by the real; is not the ordinary sense of the word "real" a warning of how easy it is to confine our ideas to the particular example and lose the sense of the wider truth which underlies the particular example.

The word "real," that modern outcome of scholastic thought, if it means anything, means that which is "res," a definite concrete thing, and our use of it to connote the true, the "very" to use the good old word, is itself a warning how much our thought is bound down to the particular example that we know, and how apt we are to lose the sense of the wider truth, that we at best but half know and but half comprehend, but which is far truer than the real.

Are we not in danger of being caught in the meshes of our own thought. Even the wisest and best theory may be a trap, if we fail to recognise that it *must* be an imperfect explanation of the whole of the truth, unknown and unknowable in the fullest sense. We feel that the theory is "real," it is clear, definite and conclusive and exactly suits our power of comprehension; therefore let us beware of supposing that it is exhaustive. Nature is greater than our minds, and therefore if a theory is no greater than our minds, it must be smaller than the truth of nature. Just in proportion as a theory satisfies us, it bears upon it the evidence of incompleteness; and if we do not take care we may become hide-bound by it. Lavoisier's theory of the proportionate combination of elements: Dalton's theory of atoms: were magnificent and have borne fruit in much of the wonderful progress of modern science; and yet in their very perfection, they left out a something that the older phlogiston theory, erroneous and imperfect as it was, had got a glimpse of. Even their very success threw back the investigation of "thermochemistry" which is not less important to the grasp of the whole problem. Only a few years ago we were tempted to feel satisfaction in our

grasp of the possibilities of the vibrations of the ether, and we had got a long way, no doubt, but Rentjen and his collaborators, who were not hide-bound, have compelled us to open our minds to the possibilities of vibrations of the extent of which we are by no means satisfied yet.

We must have theories; we cannot make progress without them; even a false theory may be better than none. Take for example, the theories of the alchemists; they were false, no doubt (though the possibility of transmutation seems now by no means so unthinkable as it did a while ago); yet false as they were, they served as an encouragement to the study of natural phenomena and indirectly laid the foundations for modern science.

Then again, popular ideas are mostly more or less wrong, but they embody an unconscious and unscientific summing up of experience that it is rarely wise altogether to ignore. Forty years ago the Italian peasant was nearer the mark in calling cholera "aquetta" and attributing it to poisoned wells, than the more educated people who learnedly discoursed of "blue haze" and so forth. Long ago experience had shown that there was some connection between malaria and mosquitos, improbable as it seemed to scientific thought.

Let us therefore hold fast to our theories—to our ideas—taking infinite pains to choose the best; those that are alike most far-reaching and most based on experience; yet never holding them as absolute truth, never saying that something is impossible because it will not come within their limits. Even though something be unknowable, let us be very careful not to say that it cannot be.

It may be said that this is all mysticisin and dreams. Possibly, and yet it may be that there is an ignorance worse than dreams. The Germans make a distinction, untranslateable into English, between *das mystic*—the feeling after a truth too great for comprehension—and *das mysticismus*—which is, to put it vulgarly, muddle-headed dreaminess. It is the first that I wish to plead for in science, especially to beginners filled with a sense of how much they know. I would urge such ever to hold fast to theories; without them progress is impossible. Try and grasp the ideal that underlies the real, and is more true than it; but

never allow yourselves to be satisfied even in your ideal. Never lose sense of the imperfection of human knowledge and especially of your own. Never allow the sense of what has been known, great and wonderful as that is, to dim the higher sense of how little we know as yet, how much there is to know.

FISH-HOOKS OR GORGES OF WOOD FROM FRANCE (SIMILAR TO THOSE FROM ESSEX).

By EDWARD LOVETT.

[*Read January 26th*, 1901.]

In the ESSEX NATURALIST for April, 1898 (vol. x., pages 300-305) I described and figured some primitive fish-hooks of wood still in use on a part of the coast of Essex. At that time I had heard that similar hooks were used in some parts of France and Russia (and probably elsewhere). For some time I made every possible enquiry as to these, but without success.

At length, however, I was fortunate in hearing that M. François Daleau, of Bourg-sur-Gironde, France, could assist me, and I at once wrote to this gentleman. His reply was indeed a surprise, for it was to the effect that on the Gironde fish-hooks of wood were used, not only like the Essex form, but actually made of the same wood, the White-thorn.

I sent him a line of our Essex thorn hooks, with a copy of the ESSEX NATURALIST containing my paper, and he very kindly gave me a series of similar hooks from his locality, together with a copy of his most interesting pamphlet, extracts from which I have reprinted below.

It will be seen from his paper that the "survival" of the primæval fishermen is almost exactly alike on the Essex coast, and on the banks of the Gironde, but at the latter place we find the true gorge which again was evidently known in Essex, as will be seen from my correspondence with "Tom" recorded below

This true gorge is most interesting as regards its distribution, for I have stone examples of it from Hudson's Bay; bone specimens from Alaska (for catching sea-birds); and turtle-shell forms of the same thing from Santa Cruz, for taking Flying-fish.

The prehistoric type of fish-hook made of Mammoth ivory, described in M. Daleau's monograph, is represented in chert in North America, and in flint in this country.

These latter are, however, but little understood, for in some museums they are described as "awls," whilst in others they are more discreetly labelled "use unknown."

I now give some extracts from M. Daleau's report on:—

"HAMEÇONS MODERNES EN BOIS.

"Quelques vignerons habitant les bords de la Dordogne, dans les communes d'Ambès et de Prignac-et-Cazelles (Gironde), se livrent aux plaisirs de la pêche durant leurs moments de loisirs. Les hameçons en bois qu'ils fabriquent et dont ils se servent encore pour la pêche de l'anguille ont depuis longtemps attiré mon attention. Ceux que je possède figurent dans ma collection depuis 1876.

"Ces engins sont de deux types differents, appelés dans le pays, l'un *Hain* ou *In*, l'autre *Clabéou ou Claveau*.

"L'hain (Fig. 1) est un petit hameçon bifide en forme de fuseau, long de deux à trois centimètres, taillé dans un mince morceau de *brande-à-balais (Erica scoparia)*, acéré aux deux extrémités, fixé solidement au centre par un fil simple, long d'environ 35 centimètres.

"Le *clabéou* ou *claveau* (Fig. 2) est fait d'une petite épine de *bret blanc* (*Cratægus oxyacantha*), tenant à un morceau de sa tige, taillé en pointe à la base, évidé en gouttière au coude, pour faciliter le passage d'un fil double qui, maintenu près de la pointe par un nœud coulant, vient ensuite s'attacher à la naissance de l'épine.

"Ces hameçons en bois, que la plupart de nos pêcheurs d'occasion préfèrent aux hamegons en acier, sont employés comme je viens de le dire pour le pêche de l'anguille.

"Le vigneron procède de la fagon suivante: les engins, souvent au nombre de plusieurs douzaines, sont amorcés avec des vers de terre que l'on enfile jusqu'à ce que le bois soit complètement recouvert, l'extrémité opposée du fil est attachée à un bâtonnet de trente à quarante centimètres de long que la pêcheur enfonce entièrement dans le sol détrempé du rivage à marée basse; l'eau monte, couvre l'engin et, un peu avant l'heure du flux, on va voir *si l'anguille a mordu* (terme local).

"Des chasseurs m'ont affirmé avoir vu sur les bancs de sable et sur les berges des îles du bas de la Gironde, des hameçons en bois plus longs que les hains, que l'on dissimule sous des morceaux de foie ou de poumons de bœufs, avec lesquels les indigènes capturent des canard sauvages et des *flahus* (Courlis)."

[Appended is a translation of the above passages from M. Daleau's paper, for which we are indebted to the kindness of Miss Mary H. Cole. ED.:—

MODERN FISH-HOOKS OF WOOD.

Some vinedressers who live on the banks of the Dordogne, in the parishes of Ambés and Prignac-et-Cazelles (Gironde) indulge in the pleasures of fishing during their leisure moments. The wooden fish-hooks which they make and which they still use for eel-fishing, have for a long time attracted my attention. Those which I have, have figured in my collection since 1876.

These instruments are of two different kinds, called by the natives *Hain* or *In*, and *Clabéou* or *Claveau* respectively.

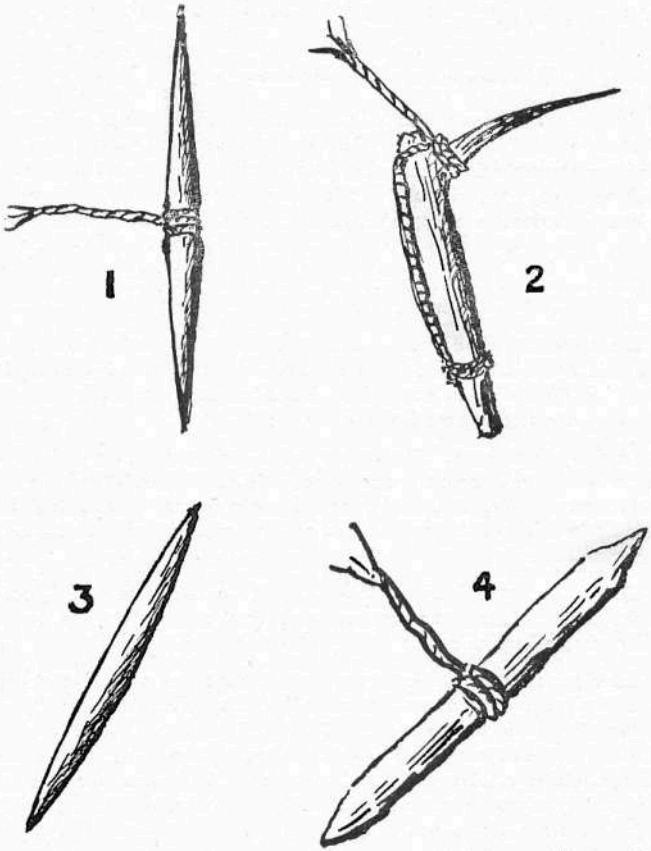


FIG. 1. L'hain (wooden fish-gorge). FIG. 2. Clabéou or Claveau (thorn fish-hook) Gironde. FIG. 3. Pre-historic fish-gorge of ivory, Cave-deposits, Giroude. FIG. 4. Fish gorge from the Essex coast, recent.

L'hain (Fig. 1) is a small fish-gorge pointed towards both ends, in the shape of a spindle, about two or three centimetres long, cut out of a slender twig of heath (*Erica scoparia*) sharpened at both ends, firmly secured at the centre by a mere thread, about 35 centimetres long.

The *Clabéou* or *Claveau* (Fig. 2) is made out of a small White-thorn (*Cratægus oxyacantha*) thorn on a portion of the stem, which is cut into a point at the bottom, and has a groove cut round it to admit of the passage of a double thread which is kept in position near the point by a slip-knot, and is then fastened at the base of the thorn.

These wooden fish-hooks, which the majority of our amateur fishermen prefer to steel fish-hooks, are used as I have just said, for eel-fishing. The vinedresser sets to work in the following way; the hooks, to the number often of several dozen, are baited with earthworms, which are stuck on until the wood is completely covered up; the end opposite the thread is fastened to a small stick 30 or 40 centimetres long which the fisher plunges entirely in the damp soil at the river's edge at low tide. The water rises and covers the fishing rod, and a little before flood-tide they go to see whether "the eel has bitten" (local term).

Some sportsmen have assured me that they have seen on the sand banks and shores of the islands on the lower Gironde, wooden fish-hooks longer than the "hains," which are hidden by pieces of liver or ox "lights," and with these the natives catch wild ducks and curlews.

M. Daleau then goes on to describe some exceedingly interesting finds in Cave-deposits of Marcamps (Gironde) of small objects made of Elephant (Mammoth ?) ivory (Fig. 3) which he very logically considers to be the pre-historic ancestors of the "*Hain*" used by the peasants of the same district in the present day.

When I had read this most interesting paper I wrote at once to our old friend "Tom" in Essex asking him if he had ever used any other kind of wooden hooks than those he had already sent me.

His prompt reply very much astonished me, for he enclosed a few specimens of a gorge (Fig. 4) which he stated he formerly used; but after further enquiries on my part he could give no reason for doing so, nor did he know where he got the idea from. A more interesting case of unconscious heredity I have never met with.

As regards the other remarkable coincidences in M. Daleau's report, I can only add that he was as much interested to hear of a similar survival in our country as I was to hear of the use of the Essex wooden hooks in the valley of the Gironde.

NOTE.—I shall be glad to be informed of other records of similar hooks from any part of the world, or to receive any observations upon this interesting subject.

ANNUAL REPORT OF THE COUNCIL FOR THE YEAR ENDED DECEMBER 31st, 1900.

[Read and Adopted at the 21st Annual Meeting, March 30th, 1901.]

The year 1900 will be memorable in the annals of the Club. Not only did it complete twenty-one years of work, but it also witnessed the realization of the vision of a permanent County Museum of Natural History, which from the beginning has been an ideal of the Club, and which was first put into the practicable shape of a resolution at a meeting held at Mr. E. N. Buxton's house on December 8th, 1883, seventeen years ago. Within the year were also completed the extensive repairs and restorations of Queen Elizabeth's Lodge, thus affording a most suitable home for the Epping Forest Museum.

FINANCE.—The Statement of Account for the past year reveals the sound policy pursued by the Council of the Club, in steadily reducing the debit balance on the General Account, which, from over £100 in 1896, has sunk to a few shillings at the present time.[1] The other accounts are also in a healthy condition, that relating to Special Memoirs and Publications alone showing a deficit; and against this may be set the value of the stock, for which a steady, though not a rapid sale may be predicted. The Forest Museum will demand the best energies of the members of the Club in the immediate future, the balance in hand being entirely out of proportion with the needs created by the necessary re-organisation.

MEMBERSHIP.—The list of members issued in the autumn, corrected up to Dec. 31st, shows a total of two hundred and eighty-eight, made up as follows:—Life Members, 29; Annual Members, 241; Exempt Members, 4; Honorary Members, 14. Of these twenty-two were elected during the year; the losses, from various causes, totalled twenty-six.

By death the Club lost four distinguished Honorary Members; two Life Members (Mr. Leaf and Mr. Ramsden); and six annual members. Thirteen members resigned, and one was amoved. Every effort should be made to fill up the vacancies at an early date.

MEETINGS.—Thirteen meetings were held within the year, including that in connection with the opening of the Central Museum, and a meeting in futherance of the objects of the Epping Forest Museum. As in former years, the Council have pleasure in acknowledging the services of those gentlemen who so kindly aided in the conduct of the meetings. At the meeting at the College of Surgeons on January 27th, Prof. Charles Stewart, F.R.S., gave one of his charming demonstrations of the contents of that magnificent Museum; at the meeting on February 14th, Mr. Lovett gave a demonstration lecture on Crustacea; on March 31st, Mr. S. Salmon conducted a meeting for the observation of the Mosses of Epping Forest; and on May 19th, Mr. G. Massee, F.L.S., acted in a similar capacity with regard to the minute Fungi. At the meeting on July 9th, Mr. Turner kindly acted as botanical guide in the Witham and Tiptree district; at this meeting the members were most

1 In the report of the Council for 1899 the printers inserted in error the Statement of Account for 1900 instead of that for 1899 (see last volume, pp. 306-7). The latter is now inserted to make the series complete.

hospitably received at the Tiptree Heath Fruit Farm by Mr. Wilkin and his family. At the Annual Fungus meeting on October 6th we had the great benefit of the assistance of Dr. Cooke, Mr. Massee, F.L.S., Mr. R. Paulson, Mr. F. O. Pickard-Cambridge, and Mr. Frank Smith The Council are fully sensible of the honour conferred upon the Club by the Countess of Warwick in consenting to open the Museum on October 18th and the ceremony was rendered the more valuable by the excellent address delivered by her Ladyship on that occasion. The thanks of the Council are also due to Prof. Meldola for the address delivered by him at the opening ceremony, and to Mr. E. N. Buxton for kindly taking the chair at the meeting on December 8th in support of the Forest Museum. An experiment was made on July 20th and 21st to interest the members in the collecting work of the Museum by means of two dredging excursions in the Colne Estuary. The Council regret that financially the experiment was unsuccessful, although otherwise the meetings were exceedingly interesting; there were, however, some drawbacks in weather and possibly other reasons for non-attendance, and the experiment might well be repeated with a somewhat varied programme. The whole of the above-named meetings have been, or will be, fully reported in our Journal.

ESSEX NATURALIST.—Members are referred to the paragraph on this subject in the last Annual Report. Two parts were published within the financial year, and much matter is in type ready for another part. The Council has again to thank Mr. H. A. Cole for some drawings for reproduction and Mr. F. W. Reader for assistance in getting matter ready for press. Mr. Reader has also kindly presented the blocks for use in the memoir of General Pitt-Rivers. But as this memoir will not be published until 1901 further reference to the matter will be made in next year's report.

ESSEX MUSEUM OF NATURAL HISTORY.—With respect to the Central Museum the Curator again finds it desirable to postpone a full report until the various collections are in a more forward state of arrangement. Many changes will be made during the ensuing summer, and the cases now being made, or refitted, will much improve the Museum. The members are again referred to the *Museum Handbook, No. 5*, and to the various reports in the ESSEX NATURALIST which contain most of the business details. The building was finished in the early part of the year and in April the temporary premises at Forest Gate were given up, and the whole of the collections, cabinets and cases with the books, were removed to the new Museum. Mr. Passmore Edwards' munificient donation of £1,000 enabled the Municipal Technical Instruction Committee to fit up the very handsome Museum wall-cases and floor-cases now in the Museum. As soon as the furniture was in position, the Curator commenced the preliminary arrangement of the collections, so as to get the space available at least planned out before the date fixed for the opening of the Museum. In this high-pressure work he was greatly assisted by Mr. W. H. Dalton, Mr. J. E. Harting, Mr. H. A. Cole, and Mr. F. W. Reader. Mr. Dalton commenced the arrangement of the students' geological collections, and Mr. Harting put together and presented to the Club the very interesting collection of birds and trappings to illustrate the modern practice of Hawking which now adorns the Central Hall. A great many birds and mammalia were obtained and preserved by Mr. Pettitt and Mr. Burton, the Club's taxidermists, and a commencement was made with

ESSEX FIELD CLUB.

Treasurer's Statement of Receipts and Expenditure for the Year 1899.[1]

GENERAL RECEIPT AND EXPENDITURE ACCOUNT.

Receipts.	£ s. d.	£ s. d.
To Subscriptions, 1897	3 15 0	
,, ,, 1898	9 11 6	
,, ,, 1899	144 1 6	
,, 1900 (in advance)	1 10 0	
		158 18 0
,, Life-Compounders for *Essex Naturalist*		9 0
,, Balance forward (Deficiency)		26 9 1
		£185 16 1

Expenditure.	£ s. d.
By Balance (Deficiency from 1898)	43 8 0
,, Printing and Illustrating *Essex Naturalist* (2 parts) ...	42 9 3
,, Printing (Circulars, &c.) and Stationery	8 8 9
,, Postage of *Essex Naturalist*, Circulars, Correspondence, etc.	15 0 3
,, General and Incidental Expenses	9 7 8
,, Library Expenses	5 6 4
,, Lecturers' Fees	3 13 6
,, Amount transferred to Essex Museum (West Ham) Maintenance Fund	50 0 0
,, Loss on Field Meetings, as *per* Hon. Secretary's Statement	6 18 11
,, Loss on Tea Fund *do. do.*	1 3 5
	£185 16 1

SPECIAL MEMOIRS AND PUBLICATIONS ACCOUNT.

Receipts.	£ s. d.
To Sale of Publications	8 1 6
Balance forward (Deficiency)	18 13 5
	£26 14 11

Expenditure.	£ s. d.
By Balance (Deficiency from 1898)	25 16 5
,, Cost of Prospectus of *Essex Mammals*	18 6
	£26 14 11

EPPING FOREST MUSEUM CAPITAL AND MAINTENANCE FUND.

Receipts.	£ s. d.
To Subscriptions	6 10 0
,, Balance forward (Deficiency)...	4 19 7
	£11 9 7

Expenditure.	£ s. d.
By Balance (Deficiency from 1898)	4 1 10
,, Oil for Lamps	3 8 8
,, Gratuity to Caretaker	1 0 0
,, Curatorial Expenses	10 7
,, Fire Insurance	13 0
,, Fawn stuffed and mounted	1 15 0
	£11 9 7

ESSEX MUSEUM (WEST HAM) EQUIPMENT FUND.

Receipts.	£ s d.
To Balance	150 7 6
,, Donations	54 2 0
	£204 9 6

Expenditure.	£ s. d.
By Printing, Postage, and Stationery	7 2 0
,, Carriage of Goods from Germany	1 0 11
,, Apparatus and Fittings	39 14 11
,, Specimens	17 19 3
,, Sundries	6 18 7
,, Balance at Lloyd's Bank, December 31st, 1899	131 13 10
	£204 9 6

ESSEX MUSEUM (WEST HAM) MAINTENANCE FUND.

Receipts.	£ s. d.	Expenditure.	£ s. d.
To Balance	16 2 6	By Rent at Woodgrange Road	28 3 4
,, West Ham Corporation (1898)	41 13 4	,, Curator's Stipend	73 6 8
,, ,, ,, (1899)	100 0 0	,, ,, Railway Fares	10 15 10
,, General Account for Amount transferred under Agreement of July 25th, 1898	50 0 0	,, ,, Disbursements	23 3 2
		,, Fire Insurance	1 2 6
		,, Sundries	2 13 1
		,, Balance at Lloyd's Bank and in the Curator's hands ...	68 11 3
	£207 15 10		£207 15 10

LIFE COMPOSITION ACCOUNT.

	£ s. d.		£ s. d.
To Balance from 1898, being the amount due in respect of the Life-Compositions of existing Members	104 10 6	By Balance forward	115 0 6
,, Life-Composition paid by Mr. Bryan	10 10 0		
	£115 0 6		£115 0 6

SUMMARY OF BALANCES, JANUARY 1st, 1900.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
To Essex (West Ham) Museum:—			By Cash at Lloyd's Bank:—		
Equipment Fund	131 13 10		Equipment Fund, Essex Museum... ...	131 13 10	
Maintenance Fund	68 11 3		Maintenance Fund, Essex Museum ...	61 14 5	
		200 5 1	Life Composition Fund	57 4 8	
,, Life Composition Account		115 0 6	General Account	2 4 5	
					252 17 4
			By Cash in hand—		
			Curator (Maintenance Fund)	6 16 10	
			Hon. Sec. (General Account)	1 15 4	
					8 12 2
			Hon. Librarian (Mr. Lockyer)	...	3 14 0
			By Deficiencies:—		
			General Account	26 9 1	
			Special Memoirs and Publications Account ...	18 13 5	
			Forest Museum	4 19 7	
					50 2 1
	£315 5 7				£315 5 7

Having examined the above Accounts with the books, vouchers, and pass-book, we find them in accordance therewith and correct.

WALTER CROUCH,
JOHN D. COOPER, } *Hon. Auditors.*

N.B—The Club possesses other Assets, consisting of Stock of Publications, Books, MSS., Copyrights, Specimens, Cabinets, etc.

1 The Statement for 1900 was inserted by mistake in previous volume, pp. 306-7.

collection of fishes and reptiles, crustacea, and insects, &c. A full report of the opening ceremony has been already printed in the ESSEX NATURALIST (vol. xi., pp. 319-331).

A series of *Handbooks* to the different collections in the Museum has already been commenced. One on the scope and business details of the Museum was prepared by the Curator, and contains a portrait of Mr. Passmore Edwards; Mr. Dalton has written one on the collection of Crag Fossils, and Mr. Reader on the Prehistoric Collections. To these gentlemen the Council tender their warmest thanks. It is intended to continue the series as funds will permit and the handbooks will be sold in the building at a small price.

THE EPPING FOREST MUSEUM.—The restoration of Queen Elizabeth's Lodge in order to afford more space for the Museum, and to put the building into a thorough state of repair, has now been completed. The matter is thus referred to in the Report of the Epping Forest Committee of the Corporation of London, received and passed by the Court of Common Council on February 14th:—

"The additions and alterations to Queen Elizabeth's Lodge have been completed at a cost of £1008. The restoration has given great satisfaction, and the Museum is now in course of re-arrangement, not only in the Banqueting Room, where it has existed for some years, but also in the renovated 'Oak Room' on the first floor."

Of this sum of £1008 the Council of the Club contributed £50 out of the Fund subscribed, towards the cost of fitting up a small room on the ground floor as a Curator's room. Several meetings of the Council and Committee have been held to consider and formulate the plans of work for the fitting up of the Museum in an adequate manner. It is the wish of the Corporation Committee that no high cases should be placed in the rooms. This necessitated some change of plan, and it has now been decided that no general collection of vertebrates should be exhibited, and that the upright cases and such specimens of vertebrata as were in the Museum (other than loan collections) should be removed to the County Museum at Stratford. It is intended to represent the birds, &c., in the Museum by a few cases of "groups" similar to those in the British Museum; but these will be very costly and must be specially provided. At the meeting held on December 8th last, the plans were settled and agreed upon, Mr. E. N. Buxton being in the chair. See full report in the ESSEX NATURALIST (vol. xi., pp. 300-303). A subscription list (which now amounts to over £100) has been started, and the alteration and construction of cases, &c., will be taken in hand at once. At the wish of the Corporation Committee the building is now open to the public, but the re-arrangement of the Museum must necessarily take a long time, and it is obviously better to reserve a full report until the work is completed. The Curator hopes to get the Museum into a fair state of completeness by the spring of 1902. Meanwhile the active sympathy and support of all our members is solicited for our Curator, whose task in organising and arranging two large Museums is one both difficult and onerous.

RETROSPECTIVE.—Inasmuch as the year 1900 completed the 21st year of the existence of the Club, it may be useful to record a few brief notes on the work accomplished during that period.

The Club was founded in the last months of 1879 by meetings called together by Mr. W. Cole, and the issue of a very large number of letters to the leading inhabitants of the County. The original advertisements, prospectuses, and the Rules were drawn up by Mr. Cole, and settled by the late Charles Browne, M.A., who acted as the first Hon. Counsel to the Club. The Inaugural Meeting took place on January 10th, 1880, at the rooms of the Epping Forest Art Classes, St. John's Villas, Buckhurst Hill. Mr. Meldola was unanimously chosen as the first President, and it is in the recollection of all the original members of the Club how much the Society owes to his guidance and scientific knowledge. His address delivered at the first Ordinary Meeting of the Club on February 28th, 1880, clearly laid down the lines upon which the policy of the Club was founded, and since that period Prof. Meldola has ever been ready with advice and assistance in the conduct of the affairs of the Society. Mr. Meldola retained office for three years; then Prof. G. S. Boulger took the post of President for two years, to be succeeded by Mr. T. V. Holmes, who filled the chair from 1885 to 1887. Mr. E. A. Fitch was President for four years (1888 to 1891). Then Dr. Henry Laver served for one year and Mr. Chancellor for two years. Mr. Howard was elected in 1895, and consequently has filled the office for six years. The Council most gratefully acknowledge the great value of the services of these gentlemen; under their guidance the Club has maintained a high position among similar societies. It is a matter of great satisfaction to say now that the Club is in a fair way of accomplishing all the objects laid down in the original Rules and in Prof. Meldola's Inaugural Address.

Second only in importance to the President is the office of Treasurer, and the Club has been fortunate in securing the services of gentlemen who have given much time and labour to its arduous duties. Mr. H. J. Barnes was the first Treasurer, acting during 1800 and 1881; then Mr. Andrew Johnston held the office during five years from 1882 to 1886; Mr. Thomas Royle acted during 1887 and 1888. Then Mr. A. Lockyer was Treasurer for seven years from 1889 to 1895, and in 1896 Mr. Waller took the office which he resigns to-night, after acting for six years.

Mr. W. Cole was the first Honorary Secretary. It may be noted that he has attended in this capacity every Meeting and Committee Meeting of the Club, with the exception of three Field Meetings, once through illness and the others from business connected with his duties under the County Council. Mr. Cole has also edited the Club's publications from the beginning and has reported every Meeting in full in the publications of the Club and in the Minute Books.

Mr. B. G. Cole has served as Assistant Hon. Secretary since his first election in 1882, and on him has mainly fallen the trying and sometimes unpleasant task of conducting the business details of our numerous Field Meetings.

The Club owes a debt of gratitude to Mr. A. Lockyer, who was the first Librarian, and who inaugurated the system of exchange of publications with other societies. He served in this capacity until 1886. In 1887 Mr. Wire took the office and 1893 was joined by Mr. E. Durrant. Mr. Lockyer acted in 1889 and 1890. Mr. W. C. Waller acted as one of the Librarians during

several years, more particularly with regard to the sets of forest literature in the Epping Forest Museum. All these gentlemen gave most valuable services.

The Club has also largely benefitted by the services of Mr. Charles Browne and Mr. W. C. Dare as Hon. Counsel and H. J. Coburn as Hon. Solicitor.

During the 21 years the Club has held 200 Ordinary Meetings, 158 Field Meetings and 32 other Meetings, making 390 Meetings in all. But it must be remembered that two meetings have sometimes been held on the same day.

The Publications of the Club comprise five volumes of Transactions and Proceedings, eleven volumes of the ESSEX NATURALIST (the last in progress) and three volumes of the Special Memoir series, making 19 volumes in all. Up to the end of 1900 the publications comprised about 5,310 pages of matter, and of this at least 7-8ths has direct connection with the natural history, geology, archæology, history and topography of the County of Essex. The average number of pages published has consequently been 252 per annum.

The Council very much regret the death of Mr. E. Durrant, which occurred on August 30th, 1900. Mr. Durrant joined the Club in 1881, and served on the Council. He also acted as Librarian and took part as Secretary of the old Chelmsford Museum in the attempt to establish the County Natural History Museum at Chelmsford. He was the founder of the Chelmsford Society of Odde Volumes and was one of the founders and the publisher of the *Essex Review*. During many years he was a constant attendant at such meetings of the Club as were held in the interior of the County.

TREASURERSHIP.—The Club will suffer a great loss in the retirement of Mr. W. C. Waller from the Treasurership, which he has filled to the manifest advantage to the Society since March, 1896. In addition to his services as Treasurer, Mr. Waller acted as Librarian to the Epping Forest Museum, and most skilfully arranged and catalogued the interesting set of Forest papers known as the Barclay collection, an account of which was published in the ESSEX NATURALIST, vol. ix., pp. 157-160. Mr. Waller also most kindly gave his services as Hon. Secretary to the Special Committee for the adjustment of the questions between the representatives of the old Chelmsford Museum and the Club, and in many other ways has acted for the benefit of the Society. The Council return their most hearty thanks for his past services, with an expression of sincere regret at the loss of them in the future.

Mr. Howard has most kindly consented to undertake the office of Treasurer, at least for a time, and has thus relieved the club of a serious difficulty.

LIBRARIANS.—The Club is again reminded that no members have yet offered to take the offices of the two Librarians. The absence of these officers is greatly to be regretted, and as the books must now be arranged and the list of corresponding Societies revised, and the exchanges sent out, a great deal of additional work will be thrown upon the Hon. Secretaries.

AUDITORS.—The Council cannot justly omit to thank Mr. Walter Crouch and Mr. J. D. Cooper for their persevering and skilful services as Auditors during many years past. Both these gentlemen have rendered most essential services to the Club which should be gratefully acknowledged by the members.

PRESIDENCY.—Mr. Howard resigns to-night the office of President, which he has held for the unprecedented term of six years. The Council most sincerely thank him for his services, which have been in the highest degree beneficial to the Club during a period of very considerable stress. The retiring President is to be heartily congratulated at having seen during his term of office the completion of the establishment of our two museums, and the settlement of the Club in the permanent head-quarters at Stratford. Both the members and the Council are glad that Mr. Howard's aid and sympathy will be retained by his election as one of the Permanent Vice-Presidents and as Treasurer of the Club.

The Council recommend the election of Prof. Meldola as President as an event likely to advance the scientific reputation and usefulness of the Club. And they also think that the members will have pleasure in welcoming back as the head of affairs a gentlemen who took part in the inception of the Club, and who now will, perhaps, have the satisfaction of giving the finishing touches to the edifice which was so well planned out twenty-one years ago.

Two very necessary things remain for accomplishment, the increase of our membership to 400, so as to give a sufficient income for the ordinary work of the Club, and the establishment of a reasonably adequate Museum Fund which will enable the Club to collect and preserve in the Museums a really good series of Essex animals, plants, and fossils. So much has been accomplished during the past three years by a small number of persons, that all members and friends of the Club are now asked to work heartily to bring about the establishment of the museums and the other work of the society on a firm financial and scientific footing.

THE ESSEX FIELD CLUB.

TWO HUNDREDTH ORDINARY MEETING.

SATURDAY, JANUARY 26TH, 1901.

The 200th Ordinary Meeting was held in the Physical Lecture Theatre of the Municipal Technical Institute, Romford Road, Stratford, at 6.30 p m., Prof. R. Meldola, F.R.S., *Vice-President*, in the chair.

The Chairman said that the Council at their meeting that evening had considered the desirability of recording the grief which was universally felt at the lamented death of Her Majesty the Queen, and they had drawn up the following vote of condolence to the Duke of Connaught, who had been Patron of the Club since its foundation in 1880. If the Resolution met with the approval of the members, it was proposed that it should be suitably engrossed, and signed by the President and Hon. Secretary on behalf of the members, and forwarded to His Royal Highness. He begged to move the resolution in the following terms:—

"The President and Council of the Essex Field Club, on behalf of the members, by a resolution passed this day, beg to convey to

HIS ROYAL HIGHNESS THE DUKE OF CONNAUGHT,

who has been Patron of the Club since its foundation in 1880, their most respectful and heartfelt sympathy on the grievous loss which he has sustained

through the decease of his revered Mother. The members of the Club desire to make known to His Royal Highness that they, in common with all Her Majesty's subjects, share in the universal grief which the demise of their beloved Sovereign has caused throughout the British Empire."—*January 26th*, 1901.

The vote of condolence was seconded by Mr. Walter Crouch, F.Z.S., *Vice-President*, and passed unanimously by the Meeting in respectful silence.

The following were elected members of the Club: Mr. H. W. Lee and Mr. Ernest Linder, B.Sc.

Mr. F. C. Clark exhibited a small clay lamp, apparently of Roman make, which had been found in a garden at Woodford.

In the discussion that ensued it was affirmed that no evidence of Roman occupation had yet been found at Woodford. Mr. Crouch referred to the Roman remains at Wanstead, which had been described in the *Archæologia*.

Mr. W. Cole exhibited a fine specimen of the true "Old English" Pheasant, shot in the Forest by Mr. Maitland, Jun., and kindly presented in the flesh to the Museum by the Rev. J. Whitaker Maitland, Rector of Loughton. Mr. Cole alluded to the rarity of this form of a well-known bird. The usually occurring pheasant of our coverts was generally considered to be a hybrid between the true pheasant (such as the Loughton specimen) and the Chinese Ring-necked Pheasant (*Phasianus torquatus*).

Mr. Cole also exhibited specimens of a dark variety of the Common Brown Rat (*Mus decumanus*) which had occurred very rarely in one set of outhouses at Buckhurst Hill. It appeared to approach very nearly the form described many years ago by Thompson as the Irish Rat (*Mus hibernicus*), but which the best authorities now held to be simply a local melanic form of the Brown Rat (*M. decumanus*). Mr. Cole showed specimens of the Brown Rat, and the true Black Rat (*Mus rattus*) for comparison, and said that he hoped to obtain more information and additional specimens of all the forms, so as to be enabled to place a good series in the Club's Museum.

Prof. Meldola, in presenting on behalf of the authors a copy of Prof. Miall and Mr. Hammond's book on the *Harlequin Fly*, said that in 1897 at the Toronto meeting of the British Association he had had a most interesting conversation with Prof. Miall on the subject of the study of the life-histories of British insects. As this seemed a subject eminently fitted for individual observers in local Societies, Prof. Miall had, at his request, brought the matter before the Conference of Delegates of Corresponding Societies, and his remarks had been published in the Report of the Conference for that year. The monograph now laid upon the table was an excellent example of the kind of work that was so much needed in this country, and he (Prof. Meldola) hoped that the appearance of the book would have the effect that its authors desired of stimulating research in a much neglected field.

Mr. J. P. Johnson read a paper entitled "Notes on Palæolithic Implements from the Uphall Brickyard, Ilford, Essex." Mr Johnson exhibited and presented to the Club's Museum the specimens referred to in the paper (printed in present part, pp. 52-57).

Prof. Meldola, after commenting upon the implements exhibited by the author, said that he quite accepted their authenticity as true palæoliths, and congratulated Mr. Johnson on having been able to supply the first evidence from that district of the existence of man as a contemporary of the extinct animals whose remains had in former years been so frequently discovered in the Uphall pits.

Mr. Edward Lovett gave a demonstration of the employment of fish-hooks of wood in France, similar to the hooks from the Essex coast, described in volume x. of the ESSEX NATURALIST. Mr. Lovett exhibited specimens in illustration of his remarks, and also presented specimens to the Museum (see Mr. Lovett's paper in the present part, *ante*, pp. 28-31).

Prof. Meldola, said that the spirit of conservatism which had led to the retention of such ancient customs was either a blessing or the reverse, according to the point of view from which it was considered. Although, from an industrial standpoint, the persistence of a custom because our fathers did so before us was a disaster so far as concerns national progress, yet from an anthropological point of view such survivals were often of great value, and the use of wooden fish-hooks at the present day, as made known by Mr. Lovett's observations, was a most interesting case linking a modern implement with a very remote antiquity. The author seemed to him to have been fortunate enough to have secured the evidence just at the vanishing stage in this country, and in view of the rapid disappearance of all such ancient methods and traditions it was a bounden duty of observers to record similar facts whenever they came across them in the interests of anthropological science.

Mr. E. J. Lewis gave a summary of an extensive paper on the "Oak-Galls and Gall Insects of Epping Forest" which he had prepared for the ESSEX NATURALIST. Mr. Lewis exhibited a long series of coloured drawings from his own pencil, in illustration of the subject.

[Mr. Lewis's paper will be published in a succeeding part of our journal.]

Prof. Meldola said that he was particularly interested in Mr. Lewis's paper, and was much struck by the modest way in which the author had brought forward a very valuable contribution to the county natural history. He thought that the list drawn up would form a natural and fitting sequel to Mr. E. A. Fitch's paper on the "Galls of Essex" published in the early years of the Club ("Transactions of E.F.C.," vol. ii., pp. 98-156). He remembered well the sensation caused in this country on the announcement by Dr. Adler that certain Gall Insects which had been placed by systematists in different genera were cyclical forms of the same species, and he fully concurred with Mr. Lewis that in such cases both forms in the alternating generations should be referred in nomenclature to one genus only. With regard to the origin of the two forms from the point of view of the evolutionist he thought that in the light of the analogy with the Daphnias it was more probable that the bisexual form was the parent form and that the asexual form had been evolved from this. The researches of Weismann on the Daphnias where a somewhat similar alternation was observed had led that author to the conclusion that the sexual form was the parent form.

Prof. Meldola said that he was also most particularly interested in the examples of protection among galls referred to by the author. He suggested that the term "protective resemblance" would be more appropriate than mimicry in such cases. The instance of a gall protecting itself by a secretion which was attractive to ants was one of the most interesting cases he had heard of of late years. The protection was indirect; the ants protecting the gall because of the food which they found on it. This was quite parallel to the case published many years ago by the late Thomas Belt in his well-known *Naturalist in Nicaragua*. That distinguished observer had discovered that certain acacias were provided with hollow-thorns which secreted a juice palatable to ants, these insects finding both food and shelter within the thorns. By means of these standing armies of ants the shrubs were most effectively protected from other insect marauders which were immediately attacked if they alighted on the shrubs. It was a case of symbiotic association in which both insect and plant benefitted by the association and the same was doubtless true in the case of the gall mentioned by Mr. Lewis.

Mr. John Spiller, F.C.S., commented in a laudatory way on the beauty of the drawings shown by Mr. Lewis.

Votes of thanks were passed to the authors of the papers, and the meeting concluded.

THE TWO HUNDRED AND FIRST ORDINARY MEETING.

SATURDAY, FEBRUARY 23RD, 1901.

The 201st Ordinary Meeting of the Club was held in the Physical Lecture Theatre of the Technical Institute, West Ham, at 6.30 p.m., Mr. David Howard, J.P., F.C.S., *President*, in the chair.

The vote of condolence with the Duke of Connaught, Patron of the Club, on the death of the Queen, passed at the last meeting, had been engrossed on vellum and forwarded to His Royal Highness. The President read the following reply which had been received :—

"Buckingham Palace,
"*February 11th.*

"Sir,

"I am desired by H.R.H. the Duke of Connaught to convey His Royal Highness' warmest thanks to the members and Council of the Essex Field Club for the sympathy which they have shown with him in his great and deplorable loss, and to assure them of his grateful appreciation of their kind message.

"Believe me,
"Yours very faithfully,
"ALFRED EGERTON, COL.,
"Comptroller.

"W. Cole, Esq.,
"Secretary, Essex Field Club."

The first business of the meeting was the nomination of officers and new members of Council in anticipation of the Annual Meeting to be held on

Saturday, March 30th. These nominations were duly made and will be recorded in the report of the Annual Meeting.

Mr. Avery exhibited six water-colour drawings of Essex Churches with the object of ascertaining the name of the artist. They dated from 1794 to 1797. For many years they were in the possession of the late Mr. Thomas Bird, J.P., of Romford, a member of the Club. Mr. Avery also exhibited an old plan of Wanstead House Gardens.

Mr. Walter Crouch said that the coloured sketches were very interesting They resembled a number of drawings that formerly belonged to Sir Edward Hulse, Lord of the Manor of Barking.

The President remarked that the view of Little Ilford Church was an admirable memorial of a church which had sufficed for a parish containing only 250 inhabitants within his recollection. At that time Great Ilford was only a hamlet of Barking, and contained no parish church. The best estimate that could be made of the population of Little Ilford *now* was 25,000, and these parishioners certainly could not go to church all at one time!

Mr. H. W. Littler exhibited some old hand-printing blocks formerly used at Mr. Edmund Littler's Silk-printing Works at Waltham Abbey. Mr. Littler subsequently kindly presented these blocks to the Museum, and in doing so furnished the Secretary with the following notes on the subject.

NOTES ON THE HAND-PRINTING SILK WORKS AT WALTHAM ABBEY AND WEST HAM.

By H. W. LITTLER.

I have forwarded to you for the Essex Museum the hand-printing blocks I spoke about at the meeting of the Club on February 23rd. They were made and used at Mr. Edmund Littler's Silk and Cotton Printing Works at Waltham Abbey, Essex, and are exactly similar to those used in Mr. Reding Littler's factory at West Ham Abbey. These West Ham Works were afterwards sold to Mr. J. Tucker, of Messrs. Baker, Tucker and Co., and subsequently removed to Teddington. The Waltham Abbey factory was sold to Her late Majesty's Government, for the extension of the Powder Mills, about the middle of the 19th Century. Of the old silk printing factories near London I believe the only one left is that which is (or was a few years back) carried on by a Mr. Littler at Merton Abbey, Surrey. The reason that these factories (all of which were in the first instance used as silk printing works) were located on the sites of or adjacent to old Abbeys was that large quantities of pure water were required for the purpose of bleaching the silk. It was no uncommon thing for great stocks of silks to lay on the meadows adjoining the factories, while an armed guard paraded round his valuable charge. Looking now at the putrid water of the Channelsea at West Ham and Lea one can hardly realise that these two factories were established on the banks of these rivers on account of the purity of their waters. The receipt for making madder green dye for which Mr. Reding Littler, of West Ham, was famous, was kept a profound secret even from his immediate relations interested in the same work. His madder green dyed silk handkerchiefs were the beau-ideal at that time of what a sprightly coster's neck-cloth should be. This recipe I believe died with him, he only revealing an inferior

method to Mr. Tucker when he sold the factory. The original recipe was, I believe, purchased by a Mr. Reding, of Manchester, from a Persian, and descended from him to Mr. Reding Littler, who brought the industry to West Ham. Much of the work turned out by these factories was sold in London as the latest French goods on account of their high merits of design and execution, although they were solely of Essex manufacture.

The blocks I have sent are as follows:—

(*a*) Set of three blocks; pattern a dancing girl; showing the necessary blocks for over-printing in different colours.

(*b*) Two square blocks, floral pattern.

(*c*) One circular block, pattern nearly all in copper.

(*d*) Border edging block, pattern all in copper; a very fine specimen.

(*e*) Pear-shaped block, very fine work in copper, with solid parts filled up with wood.

All the above date back to quite the beginning of the 19th Century, if not to the 18th.

There are seven zinc blocks, edgings and floral designs, one bent work and one bar work; these are of more recent date, but do not show such fine design or workmanship as in the earlier ones.

In the discussion that ensued, the President said that there was much talk of technical education afforded in these latter days, but in his firm's works at the City Mills, they had several men formerly employed in these old print works, and they certainly were remarkably good workmen, showing that these old factories afforded good manual training. He remembered the Lea water in its bright days, when people used to drink it unfiltered; indeed they could get no better water.

Mr. W. Cole said that the waters of the Thames and the Lea must have been pure enough in the first quarter of the last century, for records of the occurrence of salmon in the Lea, dating as late as 1833, were known.

Mr. John Spiller, F.C.S., said the silk printing blocks on the table revived ancient memories, for when a young student at the Royal College of Chemistry, he made the acquaintance of the late James Kayess, and from 1850 to 1860 often had the privilege of visiting the West Ham Abbey Print Works, of which his friend was then manager. At that time Messrs. Baker, Tucker and Co. were proprietors with a branch establishment at Manchester; but from this immediate locality their operations were eventually banished by the gradually increasing impurity of the River Lea, and they removed to the Upper Garrett Works at Tooting. Mr. James Kayess, J.P., died on Good Friday, 1884, and was buried at Norwood Cemetery. Another well-known personage in this district was Mr. John Tucker, member of the firm. Probably the President remembered him as a perfect giant in stature and weight, whose arm-chair was a remarkable piece of furniture and passed into the possession of our former member, Mr. W. C. Barnes, of Oak Hall. This Mr. Tucker was a successful breeder of prize cattle at West Ham Abbey. Amongst other things the speaker very well remembered the early trials of mauve and magenta for printing silk handkerchiefs in or about the year 1860, and possessed specimens given to him before the process became an extinct Essex industry.

Mr. Littler was thanked for his interesting communication.

Prof. Meldola said that having been informed of the proposed exhibit by Mr. Littler he had taken advantage of an opportunity which had recently presented itself for calling attention to a somewhat kindred subject. The importance of recording the survival or the decline and extinction of ancient industries while the chance still remained had been dwelt upon by him at the last meeting in connection with the use of wooden fish-hooks. He was particularly interested to learn, therefore, from the Duchess of Sutherland that in the highlands of Scotland, in spite of the now general use of coal-tar colouring matters, there was still a large amount of dyeing of home-made materials carried on by means of native plants. The Duchess, who had taken the greatest interest in promoting the home industries of Scotland, had been so good as to forward him a list of the plants so used and the colours furnished by them, and he thought that this list was of sufficient interest to place upon record in connection with the observations made by Mr. Littler :—

VEGETABLE COLOURING-MATTERS USED AS DYEING MATERIALS IN THE SCOTCH HIGHLANDS.

Black	Alder tree bark ..	*Alnus glutinosa*
,, ...	Dock root ..	*Rumex obtusifolius*
Blue	Bilberry (with alum)	*Vaccinium myrtillus*
,, ...	Elder (with alum) ..	*Sambucus niger*
Brown	Stone lichen ..	*Parmelia saxatilis*
,, ...	Dulse	*Halymenia edulis*
,, ...	Currant (with alum)	*Ribes*
,, (yellowish) ..	Wall lichen ..	*Parmelia parietina*
Crimson (bright) ..	Corcar lichen ..	*Lecanora tartarea*
,, ,, ..	White lichen ..	*Lecanora palescens*
,, (dark) ..	Dark lichen ..	*Parmelia ceratophylla*
Flesh-colour ..	Willow bark ..	*Salix viminalis*
Grey	Iris root.. ..	*Iris pseudacorus*
Green	Broom	*Genista tinctoria*
,, ...	Furze bark ..	*Ulex europæus*
,, ...	Heather (with alum)	*Erica cinerea*
Magenta ..	Dandelion ..	*Leontodon taraxacum*
Orange (dark) ..	Bramble ..	*Rubus fructicosus*
Purple	Sundew.. ..	*Drosera*
Red (dark) ..	Rock lichen ..	*Ramalina scopulorum*
,, (bright) ..	Rue root (bedstraw)	*Galium verum*
Scarlet	Limestone lichen ..	*Urceolaria calcarea*
,, ...	Tormentil ..	*Tormentilla officinalis*
Violet	Water-cress ..	*Nasturtium officinalis*
,, ...	Bitter vetch ..	*Orobus tuberosus*
Yellow	Ash tree root ..	*Fraxinus excelsior*
,, ...	Bracken.. ..	*Pteris aquilina*
,, (bright) ..	St. John's Wort ..	*Hypericum perforatum*
,, ..	Sundew (with ammonia)	*Drosera*
,, ..	Bog myrtle ..	*Myrica gale*

[Compiled from various local sources of information for her book on *Woman's Work; Highland Home Industries*, by Millicent, Duchess of Sutherland.]

Mr. Crouch called attention to the specimen of the Bittern, recently found in the Zoological Gardens, at Regent's Park.

Mr. Cole observed that the Bittern still occasionally occurred in Essex. It was formerly found in the valley of the Roding.

The Secretary exhibited on behalf of Mr. Whitehead, the Assistant in the Museum, a specimen of *Lathyrus macrorrhizus* var. *tenuifolius*, from Epping Forest, near Goldings Hill. There was some doubt as to the specific distinctness of the form, and it was not at present known whether it was common in Essex or not.

Mr. F. W. Elliott exhibited bones found in the Forest at Monks Wood, which had been gnawed by some rodent—he suggested by rabbits.

Mr. Cole mentioned the curious fact that although there were so many deer in the forest, antlers were but seldom found. Foresters affirmed that they were eaten by some animals.

An address was then delivered by Prof G. B. Howes, LL.D., F.R.S., Professor of Zoology at the Royal College of Science, illustrated by slides shown by the electric lantern. The following is an abstract of the address :—

RECENT WORK ON MOLLUSCAN MORPHOLOGY.

By PROF. G. B. HOWES, LLD., F.R.S.

(*Abstract*).

Prof. Howes introduced his subject by briefly recapitulating the distinctive characters of the Acephala, with especial reference to the fact that under the burrowing habit and loss of the head respiratory organs had become the accessories to alimentation. He then called attention to the recent work of Drew, of Baltimore, U.S.A., on *Yoldia limatula*, particularly as concerning the labial palps, siphonal filaments, and piston-like action of the branchiæ, which together with the formation of the anchor-like foot, were shown to collectively furnish the acme of the physiological requirements of the acephalous molluscan type.

He then passed on to the consideration of the Trochosphere and Veliger larvæ ; the former as exemplified by that of a marine worm ; the latter by that of the oyster with special reference to the absence of the "head"; and by the late larva of *Vermetus*, as bearing upon the origin of the cephalic eyes.

Attention was then turned to the recent discovery, by Pelseneer, of eyes in the adult Mytilidæ, those of *Mytilus* being shown to be structurally of the *Patella* type, but post-oral, and, though innervated by the cerebral ganglia, distinct from the cephalic eyes of other molluscs. They were shown to agree in position with the post-velar eyes of the *Chiton* larva, and thereby to suggest a close connection between the Lamellibranchiata and Polyplacophora (Chitons). The limits of modification and salient features in the anatomy of the Chiton group were next indicated, leading up to the aplacophorous genus *Myzomenia* (*Dondersia*) and special emphasis was laid upon Pruvot's recent discovery that *M. banyulensis* during development is the bearer of the eight shelly plates of the true Chitons, and that the development itself is passed through within a cellular "test," from which the young mollusc escapes by a process of rupture. Referring to this "test" and its

associated parts, as something at the time of its discovery wholly new, Prof. Howes proceeded to show it to be identical with that shortly afterwards discovered in the developing *Yoldia* by Drew; and he then showed the detailed differences between the two to be comparatively insignificant, and probably due to adaptation.

Commenting upon the facts, he regarded them as of supreme importance, when considered together with those of adult anatomy; and he expressed the belief that they involve the Acephala and the Polyplacophora in a direct genetic relationship—a community of origin from some bilaterally symmetrical ancestor. He argued that the facts altogether outweigh the supposed Rhipidoglossan affinity of the Acephala with the Gastropoda, which as a group are asymmetrical.

He next passed to the work of Lacaze-Duthiers, Kowaleyski, and others, on the structure and development of the Scaphopoda (*Dentalium*), a group of Molluscs of world-wide distribution, whose affinities have always been much in dispute. Concerning their development, he agreed with Drew that their 4—5 rowed ciliary girdle, which, at first equatorial, by forward translocation and reduction of parts becomes a complex velum, is probably the homologue of the test of *Dondersia* and *Yoldia*; and he said that if this be so, *Dentalium* might hark back with these to a common ancestrial series.

Prof. Howes next sought to show it to be a conclusion from these data that the velum is either a concentrated and translocated test, or the test an overgrown velum; and he also sought to prove that the existence of the test explains such hitherto anomalous features as the duplication of the trochal-ridge in the trochosphere of *Patella* and the presence of a pre- and post-oral ciliated annulus in the larva of the Ship-worm (*Teredo*), if not the polytrochal stage generally and its variants.

In conclusion Prof. Howes dealt with the habits of *Dentalium*, and indicated the structural features which that animal presents in common with the Acephalous and Cephalous Mollusca respectively, and considered more especially its shell, which when fully formed is a tapering tube. He showed that, like this, the "shell" of the Acephalous Mollusca (dealing with the "Gaper" and certain boring species) really forms, with its associated parts, a complete tubular investment, and that its specially characteristic feature—the calcification of its opposite halves—is said by the late eminent conchologist, Paul Fischer, to be passed through during development by *Dentalium* itself. He emphasised the need of confirmation of this remarkable statement, and deduced the final conclusion that the points of morphological community between the three Molluscan groups which had been considered, simplified our conception of their inter-relationships to a degree as unexpected as it was satisfactory. By these discoveries a really great advance had been made. It strengthened our confidence in the larval form as a guide to affinity, and had come as a welcome sequel to recent work in America upon the Trilobites, which had similarly justified our trust in the Nauplius.

Prof. Howes wound up by an earnest appeal to the members of the Essex Field Club, to seek, with all possible speed, a further knowledge of the developmental history of their indigenous marine Acephala.

Remarks were made by the President, by Prof. Meldola, and Mr. Walter Crouch, and Prof. Howes was most cordially thanked for his interesting and suggestive lecture.

Prof. Howes briefly acknowledged the vote of thanks, and the meeting ended.

THE TWENTY-FIRST ANNUAL GENERAL MEETING AND THE 202ND ORDINARY MEETING.

SATURDAY, MARCH 30TH, 1901.

The 21st Annual Meeting was held at 5 o'clock p.m. in the Physical Lecture Theatre of the Technical Institute, West Ham, Mr. David Howard, President, in the chair.

The minutes of the 20th Annual Meeting, held on November 24th, 1900, and printed in the ESSEX NATURALIST, vol. xi., pp. 296-298, were read and confirmed.

Mr. Crouch, in the absence of Mr. Waller, read the summary of the Treasurer's Statement of Account which had been duly signed by the Auditors, Messrs. Walter Crouch and J. D. Cooper. This statement was received and adopted by the meeting.[1]

The President said that they could not part with their Treasurer without expressing their great regret at his resignation of office and acknowledging the debt of gratitude they owed Mr. Waller for his care and skill in the management of the finances of the Club for the long period of five years. Mr. Waller had entered upon his duties at a period of considerable difficulty, and it must be a source of pleasure to him as it was of satisfaction to the Council and members, that many of the difficulties of the Society, financial and otherwise, had passed away. The Treasurer deserved the heartiest thanks of the Club for his work. [Applause.]

The Secretary read the Annual Report of the Council for the year 1900. This was received and adopted.

At the Meeting on February 23rd last, the following members retired from the Council under the Rules:—Messrs. H. T. Brown, B. Corcoran, Miller Christy, and Rev. W. C. Howell; the two last submitting themselves for re-election.

The following were duly proposed:—Mr. Miller Christy, F.L.S., Mr. John A. Finzi, F.E.S., and Rev. W. C. Howell, M.A.; one seat remaining vacant.

As Officers the following were nominated:—

President—Professor R. Meldola, F.R.S., F.C.S., F.E.S.; *Treasurer*—Mr. David Howard, J.P., F.C.S.; *Hon. Secretaries*—Mr. W. Cole, F.L.S., F.E.S., and Mr. B. G. Cole; *Librarians*—vacant; *Auditors*—Mr. Walter Crouch, F.Z.S, and Mr. J. D. Cooper.

1 By an unfortunate oversight this Statement for 1900 was inserted in the last part of the E.N. (vol xi, pp. 306-7), in place of Statement for 1899, which is inserted in the present part (pp. 34-35).

On retiring from the Presidency (after six years of office), Mr. Howard under Rule IV. becomes one of the Permanent Vice-Presidents of the Club.

No other Members having been proposed for any office, the above gentlemen stood elected as Members of the Council and Officers for the year 1901, and were so declared by the Chairman.

Prof. R. Meldola having taken the chair as President, Mr. Howard in concluding his long term as President congratulated the Club on the position it had attained as the result of its 21 years work and thanked the members heartily for the confidence they had reposed in him during his six years of office. Mr. Howard then continued his remarks in the form of an address which is printed in the present part of the ESSEX NATURALIST.

Prof. Meldola first returned thanks on his own behalf for the honour conferred upon him by his re-election as President after an interval of seventeen years. And he begged to move a very cordial vote of thanks to Mr. Howard for his long services as President. All connected with the Club knew the care and attention Mr. Howard had given to its affairs during years of considerable difficulty. It was very satisfactory to know that they would still have Mr. Howard's services as one of the Permanent Vice-Presidents, and also in the onerous post of Treasurer, the duties of which had been carried on with such good results by Mr. Waller. He was sure they had all listened with pleasure to Mr. Howard's remarks that evening, and hoped to read them in the pages of the ESSEX NATURALIST.

Mr. Walter Crouch cordially seconded the vote of thanks, which was carried unanimously amid applause.

Mr. Howard briefly returned thanks. He said that he handed the affairs of the Club to their new President with every confidence, and he viewed the future of the Club as one full of hope.

Mr. Hugh McLachlan proposed a very hearty vote of thanks to the officers, including the Hon. Counsel and Solicitor and the Auditors, for their services during the past year. And he particularly wished to record the sense of gratitude of the members to Mr. Waller for his long and successful work as their Honorary Treasurer. The work of the Auditors had also been most valuable, and deserved their warmest thanks.

Mr. G. E. Vaughan seconded the vote of thanks to the officers, which was carried unanimously.

Mr. H. J. Coburn, as Hon. Solicitor, thanked the meeting on behalf of the officers, collectively.

This concluded the ordinary business of the Annual Meeting. Mr. Vaughan brought forward the subject of erecting memorial tablets to eminent Essex Naturalists, &c., in churches in the county. After a long discussion Mr. Vaughan withdrew his proposal for the present.

THE TWO HUNDRED AND SECOND ORDINARY MEETING.

After an hour's interval for tea, the 202ND ORDINARY MEETING was held, Prof. R Meldola, F.R.S., President, in the chair.

The President briefly returned thanks for his re-election to the chair.

Mr. Thos. R. Brooke and Mr. Thos. Hacking, A.Sc., were elected members of the Club.

Mr. Miller Christy, F.L.S., exhibited a specimen of one of the Falconidæ, a form of the Gerfalcon, shot in Hatfield Forest ten years ago by one of the Forest keepers, and which was now the property of his widow. This specimen had been seen by the members of the Club when visiting Hatfield Forest on July 21st, 1897 (ESSEX NATURALIST, vol. x., p. 178).

Mr. Christy also exhibited a series of rubbings of the "mines" of the larvæ of the Ash-bark Beetle (*Hylesinus*) which were shown as lantern slides. Mr. Christy also read some notes on the nature and characteristics of these borings, which will be published, with figures, in a future part of the journal.

Remarks on the exhibit were made by the President, Mr. Enock, Mr. Elliott, Mr. Hugh McLachlan and the author in reply.

Prof. Meldola exhibited by means of the reflecting electric lantern, one of Lippmann's colour photographs, and gave an explanation and demonstration of the scientific principles involved. In the experiments he was assisted by Mr. Briscoe, the Principal of the Institute, whom he thanked warmly for assistance and loan of instruments.

Mr. E. Sanger-Shepherd then gave a most interesting lantern demonstration of his process for producing colour photographic transparencies, and fully explained and illustrated the scientific basis of the problem. The pictures of flowers, shells, butterflies, birds, and landscapes, &c., were much admired, and Mr. Shepherd's lecture was received with hearty applause.

A discussion ensued, in which the President, Mr. Briscoe and Mr. Shepherd took part, and a cordial vote of thanks was accorded to Mr. Shepherd.

Mr. Briscoe was also thanked for his kind aid in allowing the use of apparatus for the use in the demonstrations.

Mr. Cole exhibited some proofs of prints made by the three-colour photographic process, which had been kindly sent to him by Messrs. Andre and Sleigh, of Bushey, Herts.

A paper on Neolithic Implements from the North Downs, by Mr. Johnson, was, from want of time, taken as read.

QUEEN ELIZABETH'S LODGE AND THE EPPING FOREST MUSEUM.

The summary of the Reports of the Architect and the resolutions of the Epping Forest Committee of the Corporation of London anent this matter published under the above title in the ESSEX NATURALIST, vol. xi., pp. 31-34, recorded the details of

the repairs of the Lodge up to April, 1899. Since that date the restoration has been accomplished, and the Epping Forest Committee have issued some statements respecting it, which may appropriately be reprinted, in order to make the story of this excellent piece of work complete.

In the Report presented to the Common Council on the 25th January, 1900, the following statement occurs:—

"On the 17th April last (1899) we reported to your Honorable Court as to the proposed additions and alterations of Queen Elizabeth's Lodge with the object of strengthening the structural condition and improving the external appearance of this historical and interesting building, and enlarging the Museum established there by the Essex Field Club (which has received much public favour) in accordance with the reports furnished to us by Mr. J. Oldrid Scott, the eminent architect, and we recommended that your Honorable Court should make a special grant of £500 towards the cost, which recommendation was agreed to by your Honorable Court.

"Mr. Scott's approximate estimate for the work, made in May, 1897, was £750; but after your Honorable Court had agreed to the Report, we communicated further with that gentleman, and he submitted drawings and specifications of works, and stated that, in consequence of the increase in the cost of labour and materials, his estimate must be increased from £850 to £950. We accordingly invited Tenders for the work, and accepted the lowest, being that of Mr. Arthur Porter, at the sum of £797, and a contract was entered into with him for the work.

"When the external plastering was removed, it was found that in several places the timbers had seriously decayed and weakened the building, and Mr. Scott reported that it was desirable, if not essential, that some renewal of the timbers should be undertaken; which work was not included in the contract. We, therefore, authorised Mr. Scott to do what was necessary with regard to replacing the timbers, and to provide additional sanitary accommodation.

"The works included in the contract are nearly completed, but it will be necessary to provide better means of warming the Lodge for the protection of the building itself and of the exhibits in the Museum, possibly by means of hot-water pipes. The annual expense of heating will, we have every reason to believe, be increased but slightly, if at all."

In addition to the suggestion that the building should be warmed by hot-water, the Council of the Essex Field Club asked the Committee to favourably consider a request that a small room should be set apart, in which curatorial work could be carried on. It was found that the scullery at the base of the great staircase could be so adapted at a cost of about £50, and the Club offered to contribute this amount out of the Museum Fund. The whole of the work of restoration was accomplished by the summer of 1900, and in the report of the Epping Forest

Committee, dated 31st January, 1901, the conclusion of the matter is thus alluded to:—

"The Essex Field Club, who, with the consent of the Corporation, are the custodians of the exhibits in the Museum, asked us to provide a room for the Curator, and agreed to contribute £50 towards the cost. To this we assented. We have now to report the completion of the alterations and additions to the Lodge at a total cost of £1,008 16s. 8d., less the £50 provided by the Essex Field Club. The restorations have given great satisfaction, and the Museum is now in course of re-arrangement, not only in the Banqueting Room, where it has existed for some years, but also in the renovated Oak Room on the first floor, to which it corresponds in dimensions.

"We have also the pleasure to report that the old Tapestry is being cleaned and renovated with very beneficial result."

The modifications in the plan of the Museum necessitated by the desire of the Committee that no tall cases should be placed in the centres of the rooms, are explained in the report of the meeting held on December 8th last (ESSEX NATURALIST, xi., pp. 300-303). The building is now open to the public so that the renovated rooms may be inspected, but a notice has been issued by the Curator pointing out that the museum is in course of re-arrangement. The old cases are being altered and new ones fitted by Mr. Chiswell, of Chingford. The work will be pushed on during the autumn and winter, and it is hoped that the formal re-opening of the museum may take place in the spring of 1902.

The most grateful thanks of all well-wishers of the Forest will be given to the Corporation of London for this careful restoration of one of the most precious buildings in the district, and members of the Club as well as naturalists generally will be pleased in the possession of two such excellent rooms for the museum as those now devoted to the purpose.

PALÆOLITHIC IMPLEMENTS FROM THE LOW-LEVEL DRIFT OF THE THAMES VALLEY.

CHIEFLY FROM ILFORD AND GRAYS, ESSEX.

By J. P. JOHNSON.

At a meeting of the Essex Field Club held on January 26th, 1901, I described some flint implements which had been obtained from the recent excavations on the site of the famous Uphall Brickyard, Ilford, Essex. Owing to the comparative rarity of

contemporaneous implements in the low-level drift of the Thames Valley, especially in the Essex portion, I have thought it desirable, while describing them here, to give in addition an account of some specimens which I obtained from the brickearth at Grays, together with others from Crayford. Moreover, they belong to the generally little known group of flake-tools, and have a further interest in that they well exhibit the dexterity and neatness in the art of flaking which Palæolithic man had attained at this late epoch of his reign in Britain.

The first discovery of implements in the low-level drift of the Thames Valley was made at Crayford,[1] where, beneath the chalk cliff against which the fossiliferous brickearth abuts, Mr. F. C. J. Spurrell came across a dense layer of flakes :—

"The uppermost edge of the area covered by them is about 36 feet from the present surface, the lowest nearly six feet lower. This area was thickly covered with chips for the space of about 10 feet north and south, and, as far as I know at present, 15 feet east and west . . . but I expect that it will be found to extend further . . . The fragments of flint lay touching each other, in parts to a thickness of several inches. . . The flakes are in most cases quite new and clean, always so on the lower side, very slightly discoloured on the upper. . . I have been able to piece together many of these flakes, and to demonstrate that the object sought was the manufacture of hâches, which has been confirmed by my digging out the broad end of a flint hâche in the presence of Prof. Boyd Dawkins, whom I had asked to visit the place; and later I recovered the rest of the implement. . . Some of the smaller chips leave no doubt that besides these coarser operations of blocking out, very fine work indeed was attempted. . . A few small pieces of bone were found immediately beneath the layer; but above could be seen fine specimens, and smaller ones in abundance. . . Numerous splinters of the large bones lay around and suggested their having been broken for food."

This locality has also yielded a large number of designedly shaped flakes, a characteristic example of which is shewn in Fig. 1. There can be no doubt that this was meant to be used as a knife, the thick end probably being bound round with vegetable fibre or animal sinew, after the style of the Australian knife figured by Sir John Evans,[2] and as such one cannot but admire its effectiveness. It well illustrates the clever way in which the later Palæolithic people manipulated the flint. Even more eloquent of their ability is the testimony of the spear-heads, one of which is represented by Fig. 2, for their shape is an indisputable indication of forethought and skill in execution.

1 F. C. J. SPURRELL, "On the Discovery of the Place where Palæolithic Implements were made at Crayford." *Q. Journ. Geol. Soc., vol. xxxvi.* (1880).

2 *The Ancient Stone Implements . . . of Great Britain.* 2nd edition, London. (1897).

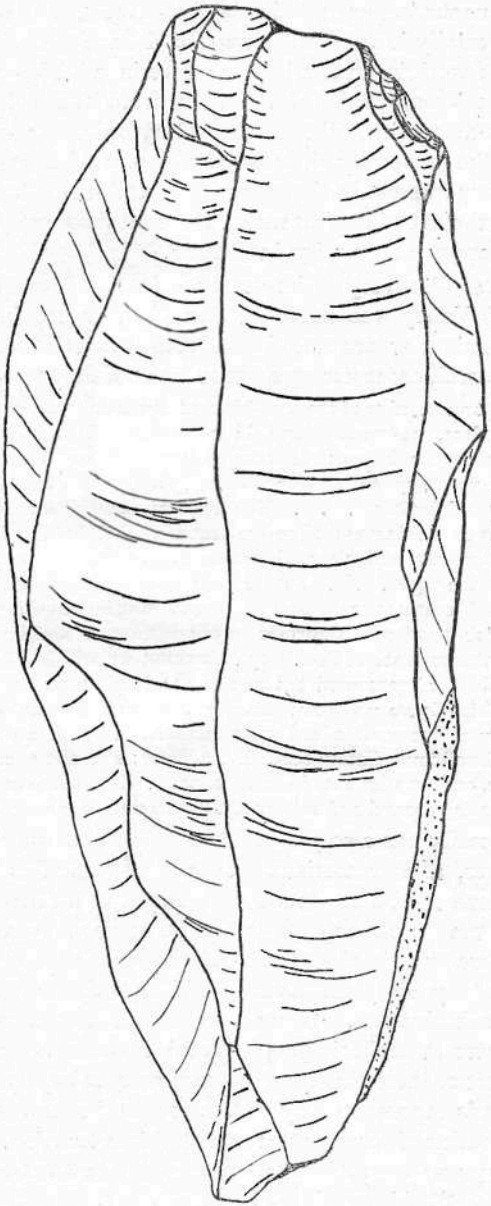


FIG. 1. Flint Knife from the Crayford Brick-earth. Nat. size.

Despite the thorough investigation of the fossil vertebrate fauna of the Uphall Brickyard undertaken by Sir Antonio Brady and others, it had not yielded any traces of man up to the time of its abandonment; and it was not until the early part of last year, when I discovered some flint flakes[3] in the pits which had then lately been opened on the classical site, that *Homo sapiens* was known to be a member of that fauna.

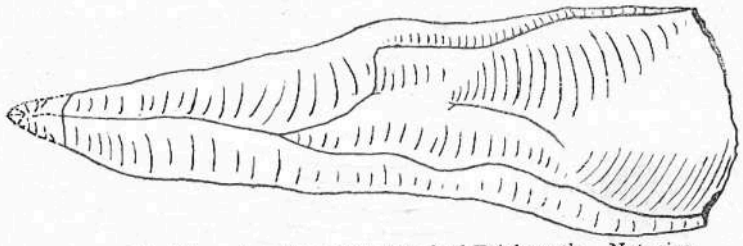


FIG. 2. Flint Spear-head from the Crayford Brick-earth. Nat. size.

One of these flakes is shewn in Fig. 3, and is another excellent sample of the neat work of the men who inhabited the Thames Valley during the low-level epoch. The best specimen however (Fig. 4), is a flake of slate-black flint which has been carefully serrated along the edge; the secondary trimming is very

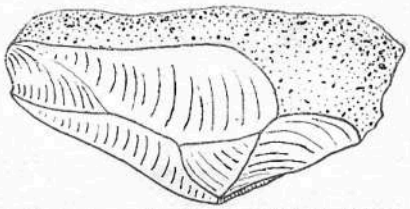


FIG. 3. Flint Flake from the Gravel at Ilford, Essex. Actual size.

fine and far superior to any I have seen from the high-level drift. I found these flakes all *in situ* in the upper part of the gravel, with which they were clearly contemporaneous, being little, if at all, worn, and quite free from ochreous stains. This same bed yielded bones of rhinoceros, together with land and freshwater shells, some of which are no longer living in this country.

While exploring the Grays district, together with my friends Messrs. Hinton and Kennard, I obtained several flint tools from

3 J. P. JOHNSON, "Additions to the Palæolithic Fauna of the Uphall Brickyard, Ilford." ESSEX NATURALIST, vol. xi. (1900), pp. 209-212. I can now also add *Vitrea radiatula* (Ald.), some shells of this Gastropod being in the collection of my friend Mr. G. White.

the shell-beds of the Orsett Road section.[4] They include, besides a neat little scraper, the well-formed flake represented by Fig. 5, the edges of which have been remarkably notched through use.

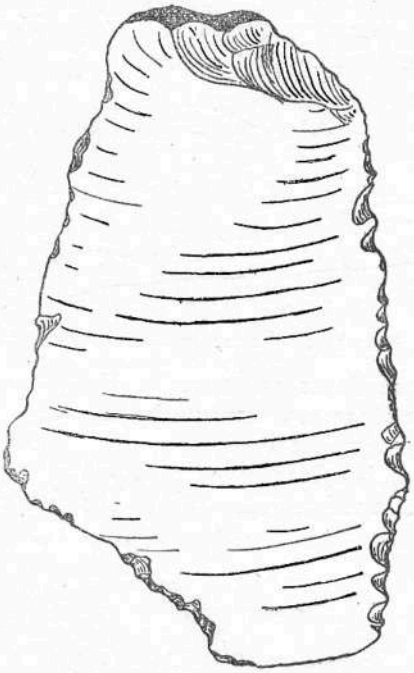


FIG. 4. Flint Saw. From the Gravel at Ilford, Essex. Actual size.

The deposits of gravel, sand and loam, which constitute the low-level drift of the Thames Valley, have yielded the remains of one of the most remarkable fauna ever gathered together in so

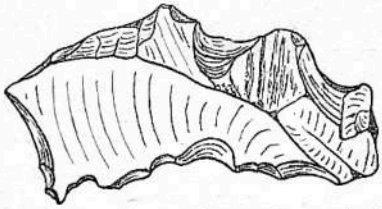
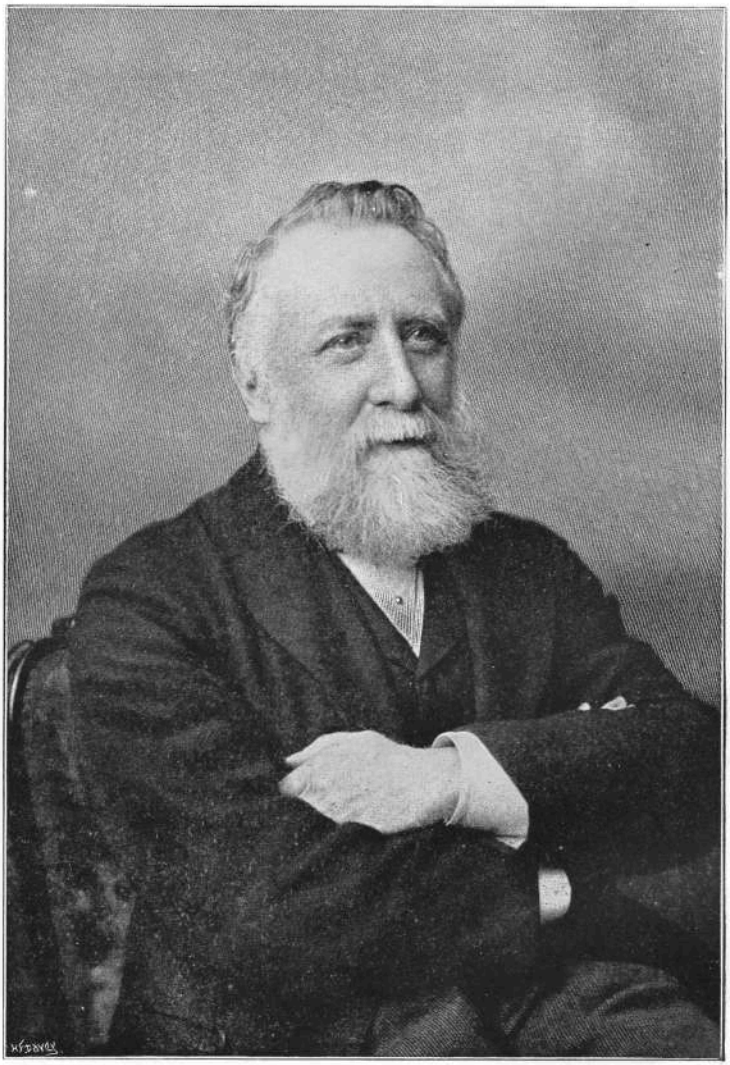


FIG. 5. Flake showing signs of use. From the shell-beds in the Brick-earth at Grays, Essex. Actual size.

4 See Hinton and Kennard, "Contributions to the Pleistocene Geology of the Thames Valley." Part I. ESSEX NATURALIST, vol. xi. (1901), pp. 336-370.



G. J. SYMONS, *President R.Met.S., Hon. Member, Essex Field Club.*
Born August 6, 1838. *Died March* 10*th*, 1900.

small an area. Bones of animals which are now only met with in different and widely separated parts of the world are mingled with those of extinct species of elephant and rhinoceros and with the primitive flint implements of the men who were their contemporaries.

What the makers of these implements were like, however, is quite unknown, as no human remains have ever been discovered, but in point of culture they could not have differed much from the more primitive of existing savages.

[I have drawn all the above figures to actual size, and have given the Essex specimens represented to the Essex Field Club's Museum at Stratford.]

OBITUARY NOTICES.

THE LATE GEORGE JAMES SYMONS, F.R.S.

[*With Portrait, Plate II.*]

It was with sincere regret that all students of science heard of the death on March 10th, 1900, of one of the greatest meteorologists that England has ever produced. By the death of Mr. Symons the Essex Field Club lost a highly esteemed Honorary Member, one always willing to give advice and assistance in the work of the Club, while his genial personality and stores of information were thoroughly appreciated on those occasions when his numerous employments permitted him to attend our meetings.

His co-adjutor and fellow-worker for nearly 30 years, Mr. H. Sowerby Wallis, has most kindly furnished us with the published memoirs of Mr. Symons from which to select materials for this notice. We have chosen that in *The Times* for March 13th, 1900, as the basis of the following, supplemented by information given in the *Quarterly Jour: Roy. Meteorological Society* (April, 1900) and in *Symons's Monthly Meteorological Magazine*, which was founded by its editor and proprietor in 1866. We have to thank the Council of the Royal Meteorological Society and the Secretary, Mr. W. Marriott, for the *cliche* of the excellent portrait accompanying this notice.

George James Symons was born in London on August 6th, 1838, the only child of Joseph and Georgina Symons, of Pimlico. He was educated at St. Peter's Collegiate School, Eaton Square, and by a private tutor in Leicestershire. From his boyhood he exhibited a love of natural science, and it is said that he offered his services as an assistant at the age of 16 to Mr James Glaisher, who, however, attempted to dissuade him from pursuing scientific investigation on the ground that it did not pay. Symons, nevertheless, persisted in his aim. At the age of 18 he joined the Meteorological Society, which Mr. Glaisher had founded, and in the course of another 12 months found employment as one of the Registrar General's meteorological reporters, an office which he continued to hold to the time of his death. For a few

years he was an assistant in the Meteorological Department of the Board of Trade under the late Admiral FitzRoy, who was then organizing his system of storm-warnings.

In addition to his official duties, and possibly in collision with them, Mr. Symons was already collecting records of the fall of rain, a pursuit the value of which Admiral FitzRoy failed to appreciate very highly, and being compelled to make choice between the one branch of work and the other, Mr. Symons adhered to his own course. He foresaw the importance of a study of the rainfall in view of the increasing demand upon the water resources of the kingdom, necessitated by the growth of population, improved and more systematic sanitation, and the additional demands of growing industries. In 1860 he published his first annual volume of the *British Rainfall*, which contained records from 168 stations—namely, 163 in England and five in Wales, there being none for Scotland or Ireland. With persistent energy he continued for 40 years to develop this unique organization of voluntary observers, His last published *British Rainfall* for 1898, contained records from 2,545 stations in England, 237 in Wales, 436 in Scotland and 186 in Ireland—a total of 3,404 stations. It is claimed for him that at the time of his death he was the head of one of the largest purely volunteer organizations in existence, having over 3,000 observers in all parts of the kingdom. His annual digest of their records is a standard work in which not only meteorologists but civil engineers, sanitary experts, and others, place unquestioning confidence.

A determining factor which encouraged Mr. Symons to persevere with studies which were then imperfectly understood and little appreciated was the recurrence of the terrible outbreaks of cholera which afflicted England and Europe throughout the middle part of the century. He was among the first to perceive in this connection the necessity of determining the amount and distribution of the water supply. His first step was to ascertain what records of rainfall were already in existence. These he found to be very much scattered. While some parts of the country were more or less covered, other very large districts were entirely without them, and such records as there were related to varying periods of time, and could not be correlated. This was the cause of his setting to work to organize a band of observers who would undertake to observe the amount of the rainfall each day, using tested gauges satisfactorily exposed and capable of giving accurate results. The need of precautions to ensure these conditions was apparent to all as soon as they were put into practice, for the *data* already in existence were proved to be frequently valueless. One gauge was discovered which had been ornamented with a small roof to protect it from the rain, which it was its purpose to measure. Others were placed where water could drip into them from over-hanging trees, and so forth. Mr. Symons visited personally and tested every gauge. The proper distribution of the gauges over the kingdom was also a part of his task. Private individuals were induced to take up the work, procure gauges at their own cost, and make the observations methodically from no motive but the public good. The result of these labours has been the accumulatiom of a mass of *data* such as exists in no other country, and which is now available for use in connexion with a variety of questions relating to the sanitary and hygienic needs of the country. Mr. Symons told of one case in which a municipality was put to the expense of many thousands

of pounds in rectifying a blunder in the calculation of the water available from a selected area, the mistake being due to the fact that a rod had been left projecting over the single gauge which formed the basis of the calculations, and that the rain dripping from the rod into the gauge was responsible for the district being credited with an absurdly exaggerated capacity for supplying water.

The rainfall was not, however, the only branch of meteorology in which Mr. Symons interested himself. To the kindred subjects of evaporation and percolation he also devoted his attention so far as they affected the underground stores of water. The use of lightning conductors was another matter in which he took interest, and, as a member of the Lightning-Rod Committee of the Royal Meteorological Society, he had much to do with the valuable report of the Committee which was the product of four years' labours. The existence of the "thunderbolt" was another subject of Mr. Symon's characteristically persistent attention. Whenever and wherever such a phenomenon was said to have been seen, Mr. Symons, if it was at all possible, himself visited the spot and investigated the evidence, with the invariable result that he could get no proof of an electric meteor having existed.

Throughout the 40 years of his work, Mr. Symons, whenever possible, adhered to his custom of giving in *The Times* a summary of his *data* respecting the year's rainfall. These observations became especially valuable during a cycle of dry years, such as 1890-99. He allowed few atmospheric phenomena of any interest to pass without some useful comment. A remarkable sunset, an abnormal barometric pressure, or a prolonged drought, were a few among many such subjects, He was for some years a member of the Council of the Royal Botanic Society. He also served on the Council of the Sanitary Institute.

Mr. Symons was a great authority on bibliography. He collected the titles of all books and pamphlets bearing on meteorology of which he could gain intelligence, and at the time of his death these titles amounted to about 60,000. In 1882 he furnished about 20,000 to the Chief Signal Office, Washington, U.S., with a view to their being printed, but this was not fully carried out. It is to be hoped that this bibliography may come into the possession of the Meteorological Society.

He was elected a Fellow of the Royal Society in 1878, and was chosen as Chairman of the Committee appointed by the Society to report upon the eruption of Krakatoa. In 1899 he was appointed a member of the Committee in connexion with the scheme for the establishment of a national physical laboratory at Kew. He was President of the Royal Meteorological Society in 1880, and he filled the office of secretary for many years up to the close of 1899. In view of the approaching commemoration by the Society early in April next of its 50th year, it sought to honour him by re-electing him President. The attack of paralysis, which intervened between his election and the subsequent meeting of the Society, prevented him from retaining the position.

For the last 30 years he has been assisted in the compilation of rainfall values by Mr. H. Sowerby Wallis, who, it is understood, will carry on the work according to the wish expressed by Mr. Symons. The Council of the

Society of Arts in 1897 awarded him the Albert Medal "for services he rendered to the United Kingdom by affording to engineers engaged in the water supply and the sewage of towns a trustworthy basis for their work by establishing and carrying on during nearly 40 years systematic observations (now at over 3,000 stations) of the rainfall of the British Isles, and by recording, tabulating, and graphically indicating the results of these observations in the annual volumes published by himself." In 1891 he was made a Chevalier of the Legion of Honour.

His energy in the pursuit of physical truths and his capacity for organizing and retaining the services of his helpers, as well as of stimulating the interest of beginners in his favourite studies, were combined with great kindliness of disposition and unaffected reticence. By none will he be more regretted than by the rank and file of his small army of 3,000 observers.

Mr. Symons married in 1866 Miss Elizabeth Luke, who helped him very considerably in his clerical work. The only child of the marriage died in infancy, and Mrs. Symons died in 1884.

His death took place on Saturday afternoon, March 10th, 1900, at his house in Camden Square, after an illness of little over three weeks. Although suffering somewhat from overwork he appeared to be in a fair state of health until February 14th, when he was seized with paralysis, from which he never rallied. He was buried in Kensal Green Cemetery on March 16th, after a Memorial Service had taken place at Holy Trinity Church, Marylebone, at which a large number of friends, and many eminent representatives of science were present, including Lord Lister, the President of the Royal Society.

A Committee was formed in June, 1900, to establish a memorial to Mr. Symons, in the form of a Gold Medal to be awarded from time to time by the Council of the Royal Meteorological Society for distinguished work in connection with meteorological science. We understand that this object has been attained and a sum of about £750 collected.

THE LATE MR TOM HAY WILSON.

Readers of the ESSEX NATURALIST will regret to hear of the death of Mr. T. Hay Wilson, in his 60th year, on May 10th, 1900, at Bushey Herts.

A native of Newcastle-on-Tyne, and long a resident there, he settled in the London district more than twenty years ago. He was for many years connected with, and latterly a member of, the firm of Crossley Bros., the manufacturers of the Otto gas engine. He became a member of the Geologists' Association in 1881, and contributed to *Proc. Geol. Assoc.*, vol, xi., p. 194 (1889), a short paper entitled "Notes on the artificial unmaking of Flints." In this paper he gives his experience of "the behaviour of Flint Shingle when exposed to the action of hot gases, and the following destructive agents: percussion, attrition, heat, with pressure, moisture, and acid." The gases are those discharged from the cylinder of a gas engine. They are driven through a chamber filled with shingle; the gases entering at the bottom of the chamber and escaping quietly through a ventilating pipe at the

top. This greatly reduces the noise which would otherwise be made by the engine when at work. Flint he found to be the only shingle which could withstand the influences to which it was exposed for any length of time, limestone being destroyed with remarkable rapidity. In one case at Oxford, where the shingle largely consisted of limestone, he states that, after the chamber had been in use only three days, "I found over two tons had almost disappeared, as a fine powder, and had been deposited over the adjacent roofs. The chamber was refilled with good flint shingle, and has not been touched for about three years." He adds that flint ultimately becomes reduced to mud, not sand. The geological bearing and interest of experiences of this kind scarcely need pointing out.

The late Mr. T. H. WILSON.

Mr. Wilson began to reside at Chingford shortly before he joined the Essex Field Club in 1886, and continued to live there till between two and three years ago. He always took a keen interest in the work of the Club, and, when he died, had been for some years a member of its Council. Though his business engagements occupied most of his time, he was a diligent student of the geology and archæology of Essex, more especially of that portion of the county within or on the borders of Epping Forest, to which he was strongly attached. He contributed many useful geological and other notes on this district to the pages to the ESSEX NATURALIST, and the present writer has been greatly indebted to him from time to time for information as to the opening of new geological sections there or the re-development

of old ones. He was also one of the most active members of the Epping Forest Museum Committee, and contributed to the Chingford Museum a small collection of rock specimens from the gravels of the Forest and of fossils from the Boulder Clay towards its northern border. He will be much missed by all who knew him, not merely on account of his scientific ability and energy, but as one of the most kindly, considerate, modest and sincere of men. T.V.H.

THE LIBRARY TABLE.

Report on the Water Supply of the County of Essex. By Dr. J. C. THRESH, County Medical Officer of Health, &c. Pp. xv, 168; 12 plates. 8vo., Chelmsford, n.d. [1901.]

It is many years since Dr. Thresh, who had already made his mark in scientific literature, brought his trained abilities to Essex, and several most valuable reports and other works have since appeared from his indefatigable pen. That before us is a compendium of information, indispensable to all who would study the question of the supply of that prime necessity of life, potable water, to the inhabitants of our county.

The work opens with a brief geological summary of the several water-yielding formations and associated impervious strata occurring in Essex, followed by a classification of their products as (1) Surface-waters, (2) River-waters, (3) Subsoil-waters, and (4) Deep-well-waters. The first are promptly condemned as all more or less contaminated with manurial or other organic substances, and occasionally with mineral ingredients such as sulphate of magnesia, derived from the surface-soil. River-waters have this objectionable feature modified by partial oxidation of the organic matter, but require further purification by filtering, at least for domestic purposes. Subsoil-waters, extensively used for isolated houses, hamlets and villages, are notoriously liable to similar or worse contamination. Unfortunately, such are utilized for the partial or entire supply of Witham, Clacton, and even Chelmsford. It may be remarked in passing that the hydrogen sulphide present in the water of newly-made wells in the Boulder Clay originates in the alteration of the iron-pyrites abundant in that clay. It is of but temporary formation, and harmless, though offensive whilst its production continue. Belief in the medical efficiency of such waters is not yet wholly extinct.

Deep-well waters, as the only satisfactory source of large supply, necessarily occupy the bulk of the report. The inter-communication of the waters of the Tertiary sands and of the underlying Chalk has been fully established, and probably the progressive deterioration by sea-water of the supply from the Chalk-wells of the Essex and Suffolk coasts is due, not to actual outcrop of the Chalk in the sea-bed (though it crosses the estuary at Grays), but to connection of the Lower Tertiary sands with those of the North Sea, where the London Clay has been removed. The many wells now drawing upon the Chalk, to an extent exceeding the supply from Kent and Cambridgeshire, induce a flow of sea-water to make up the deficiency.

Nevertheless, until the development of the Essex coalfields makes it worth while to convey water from other counties more richly endowed therewith, the Chalk constitutes the only available source for large supplies, and the

depth at which this formation lies from district to district is therefore a matter of primary importance. We do not, in saying this, ignore the speculative element involved. That a boring may pass very near to a water-charged fissure in the Chalk, and yet obtain no yield from it, is demonstrated by the few cases in which enlightened engineers have used explosives (preferably roburite) to shatter the rock around the lower part of a boring, with the result of effecting communication with such fissures, and securing their yield. This very usual practice for petroleum-wells, is, however, but little in vogue in England, though the Chalk is a rock pre-eminently suitable for such procedure. The proportion of fruitless borings in the Chalk is, moreover, very small, in comparison with the successful operations, even if we include in the failures those in which the water has in course of time become too salt for use, as mentioned above.

On pp. 20, 21 is given a table of the level of the Chalk-surface, referred to Ordnance Datum, at over 100 localities. Unfortunately this contains many clerical errors, perceptible only by reference to the records published in various works, since there are given here merely the differences between depth to chalk and elevation of site above datum. Though the author solicits correction it is impossible to deal here with more than two or three salient instances. Any traveller by the Tilbury line can see that the Chalk-surface at Purfleet is not 30 to 40 feet below sea-level, but some 50 feet above it. At Mistley, on the other hand, it is 75 feet below datum, but is given as 25 feet above it. At Bishops Stortford it is given as 328, the surface-level at the Waterworks, instead of 213, 115 feet down the well. These and many similar instances largely detract from the value of the table, a corrected re-issue of which is emphatically desirable, as is the recording in the ESSEX NATURALIST of details of all wells not yet published. Our pages will constitute the recognised storehouse and source of information for future labourers in the same field, and there are many wells mentioned in the work before us of later date than Mr. Whitaker's last series (No. iv), published in 1896 in the E.N.

In dealing with the gradual lowering of the hydrostatic level in various parts of the county, Dr. Thresh regards the bulk of water in the chalk as stationary ("stagnant" suggests unpleasant ideas), and as having little or no free communication or definite flow. The area of each "hydrological unit," represented by a single water-charged fissure, or connected group of fissures, is a matter for speculation. It does not follow that because the Southend wells are such-and-such distances apart, therefore intervening wells would be either futile or detrimental to those existing. Everything depends on the general trend of the Chalk-fissures. If, for instance, this is north-westerly, the Southend and Oakwood wells might be on one fissure of three miles length, and the Prittlewell, Eastwood, and Noble's Green wells on another and wholly independent fissure, of about the same length and half a mile distant from the first. With a different general trend each well might be a separate fissure, and in no case can it be asserted positively that wells at intervening points would affect them.

Nor, in so fortuitous a matter as fissures in chalk, can it be laid down as established that headings driven from a shaft will of necessity exhaust a larger area than the shaft itself or even than a boring on the site. If the Chalk there is sufficiently fissured, the yield is a mere question of pumping power, and the

shaft and headings are wasted labour; whilst if the rock is compact the fissures may be too far apart to be reached by headings. On the open chalk-downs, when the whole rainfall is absorbed to fill the fissures, and where the trend of the main joints is visible, the conditions render the system of shafts and headings far less speculative than would be the case in South Essex at least, where several hundred feet of Tertiary deposits overlie the Chalk. But the system would answer well enough in North Essex, and may be decreed in the Book of Fate as the ultimate general means of supplying the whole county with water, all taken above sea-level, and of incontestable purity.

For the saline ingredients of the Chalk-water, as already suggested, the Tertiary sands are probably responsible. These are of insignificant thickness on the northern outcrop, from Roydon to Sudbury, but reach 150 to 180 feet in the Southend district, and necessarily crop out in the estuary above Thames Haven. The faults traversing the southern part of the county are of insufficient magnitude to cut off the connection, with the exception of the two that, meeting near Romford, form an angular projection of what may be termed unsalted chalk, into the area susceptible of marine influence.

A comparison of Dr. Thresh's map of calcareous and saline waters (p. 34) with that of the sub-Tertiary contour of the Chalk (p. 16, taken from the ESSEX NATURALIST, vol. v, pl. iii., 1891) will shew that the boundary, except at the projection referred to, is approximately along the line at which the Chalk-surface rose above sea-level before the latest movement of depression. In other words, the limit of marine influence is on or near the line —70 of the contour of the Chalk-surface, with the exception indicated. This projection is bounded by a triangle of faults of considerable magnitude, the enclosed mass having been compressed into anticlinal arch and synclinal trough, discordant in strike with the surrounding less-disturbed areas, from which it is separated hydrologically by clay crushed into impervious walls along the faults. Dr. Thresh has thus, on purely chemical evidence, confirmed deductions from geological premises. But we must point out that the boundary is not a fault, except at that part of its course, but an old subterranean shore-line, and that faults, though not rigidly straight lines, are more angular than the gracefully-sinuous dotted line on Dr. Thresh's map, more or less diagrammatic in its character.

In the useful table of analyses (p. 37) from over forty different wells, the initials "T.S." stand for Tertiary sands, in many cases beds in, or immediately at the base of, the London Clay; in only a few instances is the supply from Thanet Sands, which the initials might equally represent.

After these generalisations, Dr. Thresh takes in succession the several Water Companies and District Councils, describing their works and the nature of private supplies utilised within their respective areas. For the clay districts generally the supply may be said to be deficient in quantity and quality, repeated mention being made, with skilful avoidance of tautology, of rainwater, ponds, ditches, shallow wells little better than cesspits, cartage for a mile or two from source, sale by the pailful, &c.

But the charges of the Companies, occupying pp. 145-167, though perhaps justified by the heavy cost of providing proper supplies, largely explain the reluctance of local authorities to close even badly-contaminated sources, and

compel resort to the costly, and not always absolutely unexceptionable, alternative. In the strait between highly probable danger to life in the natural, and certain injury to the purse in the artificial, purveyance of water to the home of the peasant, there is a tendency to evade the difficulty by a policy of "masterly inactivity," not refusing to move, but—not moving.

In a subsequent number we shall hope to summarise some of the valuable particulars which crowd this very excellent and interesting Report.

W. H. DALTON.

A Handbook of British Birds; showing the Distribution of the Resident and Migratory Species in the British Islands; with an Index to the Records of the Rarer Visitants. By J. E. HARTING, F.L.S., F.Z.S., Member of the British Ornithologists' Union. New and Revised Edition; with 35 coloured Plates, carefully reproduced from original drawings by the late Professor Schlegel. London: J. C. Nimmo, 1901. 31 + 520 pp. demy-octavo. (Price two guineas nett.)

Mr. Harting's *Handbook of British Birds* has been, for more than a quarter of a century, a standard work of reference with working British ornithologists. To say this is to say, in effect, that it has been long out of date; for our knowledge of the natural history of British Birds has advanced enormously within the last quarter of a century. Now, however, comes a new edition which is almost incomparably superior to the old. The scope and general arrangement of the work remain the same, but illustrations have been added, and, in respect of matter also, the new edition is so much larger than the old as to constitute almost a new work. Certainly it is by far the most important work on British Birds which has appeared for some years.

There is, unquestionably, an opening for a volume of this kind, written by an acknowledged authority and furnished with *coloured* illustrations. The splendidly-illustrated works of the late Lord Lilford, Messrs. Sharpe and Dresser, and others have been published, necessarily, at a price which places them above the reach of the average ornithologist. Of those works of real scientific value which have been within his reach, none have had coloured plates—for instance, Newton and Saunders' *Yarrell*, Seebohm's *British Birds*, and Saunders' *Manual*. Almost the only work on British Birds which is at once fairly complete, moderate in price, and provided with coloured plates is "Morris"—a pretentious treatise which never had any great scientific value and has long been hopelessly out of date. There has been, therefore, a long felt want for a really authoritative book on British Birds, in one volume, with good coloured illustrations, and at a moderate price. This want the present work meets admirably.

Mr. Harting's book must not be mistaken for an ordinary "History" of British Birds. It scarcely notices habits, nidification, changes of plumage, and such matters. The author's chief aim has been (as he explains) to show "the "precise status of every so-called British bird, distinguishing the rare and "accidental visitors from the residents and annual migrants." He errs, however, in claiming that this kind of information is "not to be found in any "other work on British Birds." He meant, doubtless, to claim that it was

not to be found in anything like so clear and ample a form in any other work; and he would have been fully justified in making such a claim. In this respect, indeed, his book is practically exhaustive.

The volume consists of an "Introduction," two "Parts," and a "Summary."

In the introduction we have an explanation of the scheme of the book; a general survey of the subject, including an examination of the claims of certain casually-occurring species to a place on the British list; a catalogue of the more important County or other local Avifaunas which have appeared since 1866, when Mr. Harting's well-known *Birds of Middlesex* appeared; some sensible remarks upon the much-debated subjects of classification and nomenclature, in the course of which Mr. Harting opposes (we are glad to see) the blind application of the generally-useful "priority" law; a brief "consideration of "the terms employed to designate the various groups of birds which are "placed in Parts I. and II."; and, finally, an acknowledgment of help received, from which it appears that Prof. A. Newton, Mr. Howard Saunders, and Mr. J. A. Harvie-Brown have been good enough to read through the proofs. No author could desire more competent help.

It is interesting to note that our author groups British birds as follows:—

(1) Residents	130
(2) Periodical Migrants	100
(3) Annual Visitants	32
(4) Rare and Accidental Visitors ..	167
Total	429

Part I. of Mr. Harting's *Handbook* treats of "British Birds properly so-called"—those, that is, included in the first three of the four "groups" mentioned above. Under each species, four dimensions or measurements are given—the total length, the length of bill, the length of wing, and the length of tarsus. Then follows information as to the status of the bird in Britain—its abundance, distribution, the time or times of its appearance, if not resident, and so forth. Frequently, information is added on other points—some of them, one cannot help thinking, somewhat unnecessary in a "Handbook" of the kind, though always interesting. To the working ornithologist, a very valuable feature of Part I. is found in the large number of references Mr. Harting gives to discussions of, or articles on, interesting ornithological points which have appeared in scientific journals. In these references, one sees Mr. Harting's almost-unrivalled knowledge of the literature of British ornithology.

Part II. deals with the "Rare and Accidental Visitants." Here, again, we have, under each species, the same four dimensions or measurements, for purposes of identification; together with a brief reference to the region each species inhabits, and a few critical remarks on its occurrences in Britain. The chief feature, however, of Part II. is its lists of occurrences, given under each species, with references to published authorities for each occurrence. These lists are, in style, the same as those which appeared in the well-known first edition; but they are, of course, amplified and brought up to date. They

are as complete as might be expected, in view of the fact that Mr. Harting has now spent some thirty years in perfecting them.

The Summary consists merely of a useful classified List of British Birds, in which the residents and migrants are distinguished from the rare visitants.

The illustrations, from drawings by the late Prof. Schlegel, are among the best of their kind that have yet appeared. They show, it is true, no more than the head and foot of each species; but these portions are sufficient for identification in, practically, all cases; and it will be obvious that, had the whole of each bird been shown, the book could not have been issued in one volume or at the price.

In general respects, there is little to criticise. Mr. Harting's "Introduction" shows, however, considerable (though by no means uncommon) confusion of idea as to the respective natures of a "Preface" and an "Introduction," being, in truth, both rolled into one. In the text, too we occasionally meet (especially in Part I.) with remarks which, though admirable in themselves, seem slightly foreign to the author's general plan; whilst here and there, points might have been, we think, somewhat more concisely expressed. These matters are, however, comparatively-unimportant trifles which the critic would not think worthy of notice in any but a book of the highest standing.

The *format* and "get-up" of the volume may be commended as highly as its subject-matter. The printing is excellent; the binding is plain, but in admirable taste; and there is a good index. The new edition is indispensable to every British bird-student. Within its limits, it approaches perfection. It would be hard, indeed, to imagine any very serious blemish in a work by so competent a writer, the proofs of which had been criticised by the three gentlemen named above.

We may add, in conclusion, that the Essex Field Club is indebted to Mr. Harting (one of its Honorary Members) for a copy of his work, which he has generously presented to the Library.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

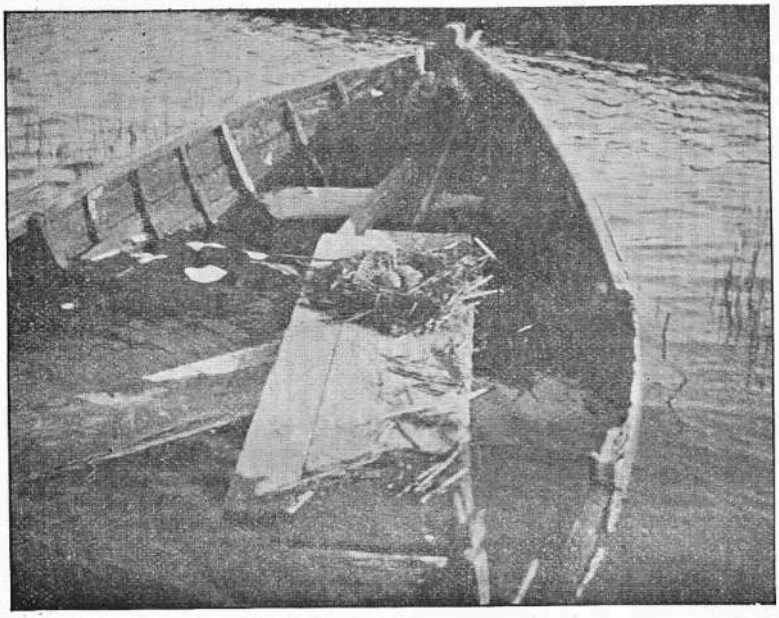
MAMMALIA.

The Long-eared Bat (Plecotus auritus) flying by Day.—On May 16th, 1901, going into my garden just before one o'clock, I noticed what I took at first for some kind of bird fluttering about in a sheltered spot between some trees close to the house. Going nearer, I saw at once that it was a Long-eared Bat, hawking for flies. While I watched it, it had a short chase after a small white Butterfly, which escaped; but it was engaged chiefly in hawking for the insects gathered round the flowers of a horse-chestnut tree. Once I saw it snap at a Humble Bee that was visiting the flowers. Its flight seemed feeble and it kept low down among the trees at one spot, but it did not seem particularly incommoded by the light, though it was so, probably, in reality; for it settled several times on the trunk of an adjacent fir-tree, clinging with its hind claws, head downward, with its ears fully extended. Once, whilst so settled it allowed me nearly to catch it. Once, too, I saw it fly into a large sequoia,

where it clung to a twig by its wing-hooks, but flew away after half-a-minute or so. On the 18th May, about one o'clock, I saw the Bat again flying about over the lawn. It seemed to fly more feebly than before, with a fluttering moth-like flight. I went out to watch it, but soon lost sight of it. It had a most strange out-of-place look as it flew about with its ears fully extended. Both days were fairly bright, but with a cold wind blowing. The only suggestion I can make to account for this persistent flying in the day time is that the bat was prevented from flying at night, as usual, by the fact that several preceeding nights had been very cold, with frosts; but I saw both Noctules and Pippistrelles on the wing, notwithstanding the cold.—MILLER CHRISTY, Pryors, Broomfield, Chelmsford.

[I have on several occasions, in Essex and Hertfordshire, seen Bats flying by day, but could not be certain of the species; they were not the Long-eared Bat.—W. COLE.]

AVES.



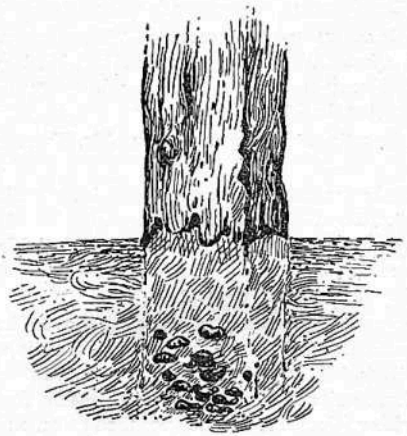
Nest of a Black-headed Gull in an old boat.

Nesting of Black-headed Gulls in Essex.—Our member, Mr. Charles E. W. Hawkins, of Old Hous, Great Horkesley, has for two years kindly sent us photographs of Blackheaded Gulls nests made in an old boat in the marshes. In sending the pictures this year, Mr. Hawkins remarks:—"The enclosed photographs are of a Black-headed Gull's nest, which I took on May 12th on one of our Essex Marshes, may be of interest. I am glad to say that there are more nests than I have known for the last twelve years." In

response to further inquiries Mr. Hawkins adds :—"The nests were photographed *in situ*, and were in the same boat as those last year. I have no doubt that the same birds chose the boat each year, as the eggs were of the same variety. On the marsh where the photographs were taken I am glad to say that there is a very marked increase in the number of nests. In one place on one of the larger "fleets" I could have covered three nests at one time with an ordinary bath towel; in fact, where there were 17 nests last year, I should say that there are more than 70 now. I noticed a rather curious thing, that where eggs had been taken from a nest, a fresh pair of birds will secure it at once." On the 27th of June Mr. Hawkins wrote :—"I was on the same marsh last Sunday and found the young gulls hatched out in the boat. Then I suppose they will have to stay for the present, unless the old birds carry them, moorhen fashion."

BATRACHIA.

A "Happy Family" of Batrachians.—Having occasion to underpin and spur a gate-post in an old garden, at a foot below the ground, I came



across a happy hibernating family which may be worth recording. I have seen large families in various situations but never so mixed a colony—three frogs, two toads, three snails, and six or seven common smooth newt or eft (*Molge vulgaris*). The wood of the post had rotted below the surface line and the mixture of soil with decayed wood probably afforded suitable bedding for a long sleep. The frogs were a few inches apart from one another, as were the toads, but the efts were curled up in close proximity, pretty much as one may occasionally see snakes hibernating in an old manure heap. One of the frogs was of the brightest yellow, with brown markings, more brilliant in appearance than any specimen I have noticed. The toads and newts showed no activity when unearthed but the frogs appeared rapidly to recover from their torpid condition. The remarks made by the workmen were illustrative of the common misconception as to innocent reptiles. The digger handed out the frogs, whereupon his companion remarked, "I wouldn't do

that for something." The toads were more gingerly touched, but neither man would handle the efts; they were left for the writer to remove.—I. CHALKLEY GOULD, Loughton, February, 1901.

PISCES.

New Records of Fish in Essex Rivers.—Mr. Edward Hesse, the well-known Fish Taxidermist, who as an angler is acquainted with our Essex rivers, has furnished some notes (dated March, 1901) which supplement the lists given in Dr. Laver's *Mammals, Reptiles, and Fishes of Essex*.

Of the RIVER CAM Dr. Laver remarked that he had been "unable to get any list or specimens of the fish of the Essex portion of this river. This is more to be regretted, as, in some parts of its course, it holds two species apparently naturally absent from all the rest of our Essex rivers . . . these two species are the Grayling, lately introduced into the Lea, and the Spined Loach." Mr. Hesse records the following as occurring in the Cam at Great Chesterford, Essex:—"Pike, Perch, Roach, Dace (very large specimens, up to 1lb. 4oz.), Chub, Minnow, Loach, Miller's Thumb, and Eel. I have not found Grayling, but the stream is quite suitable for the fish."

Of the River BLACKWATER he remarks:—"The Bronze Bream is very plentiful in the Langford Hall Fishery, near Maldon, but is not found higher up the river. It is also plentiful in the brackish water at Beeleigh Weir, where the Chelmer joins the Blackwater."

Adding to Dr. Laver's 26 fishes of the LEA Mr. Hesse records the Bleak for that river.

Of the Grayling in the Lea resulting from the introduction of fry in 1863, and concerning which Dr Laver remarks "I have not heard of the capture of any of them, but we must hope they are still doing well," Mr. Hesse says:—"A few Grayling are to be found in the Mill Pool at Hertford; fish have been caught, but they do not seem to increase."

In the RODING (no list for which is given by Laver) he finds:—"Pike, Perch, Chubb, Roach, Dace, Bleak, Rudd, Gudgeon, Minnow, Stickleback, Ten-spined Stickleback, Miller's Thumb, Eel. The river may contain Carp and Tench, but I have never seen or caught any. The Roding would be a greater favourite with anglers if it was not poached so much by the countryman."

Of the occurrence of the Barbel in Dagenham Lake, mentioned by Laver (pp. 23 and 109) he remarks:—"This, I think, must be a mistake; probably a carp in poor condition was mistaken for barbel. I have never before heard of Barbel being in the lake." It should be noted that in the list of fish given in Mr. Hilliar's paper "An Angler's Notes on Dagenham Lake," in the ESSEX NATURALIST (vol. vi., p. 146) the Barbel is not mentioned.

ARACHNIDA.

Epping Forest Spiders.—The following additions should be made to the lists of the spiders of the Forest in the *Trans. Essex Field Club* (iv. pp. 41-49) and ESSEX NATURALIST (vol. xi., pp. 315-318):—*Amaurobius fenestralis*, Stroem, abundant in winter. *Stemonyphantes lineatus*, L., a few specimens. *Araneus triguttatus*, , uncommon, Loughton. *Euryopis inormata*, Cb., a rare species; several males on a heathy ridge near Loughton,—FRANK P. SMITH.

BOTANY

Cystopus lepigoni, De Bary, in Essex.—This rare species of Microfungus was found on the leaves of *Spergularia marina* at Deadman's Point, Canvey Island, on June 23rd, by Mr. Whitehead, the Assistant in the Essex Museum of Natural History. The species was first recorded for Great Britain in September, 1864, by Mr. R. G. Keeley, who found it growing upon *Spergularia rubra* in Swanscombe Marshes. It was also recorded by Mr. F. J. Warren in 1872, who detected it upon *S. marina* at Fareham, Hants. Mr. George Massee, F.L.S., was kind enough to confirm the determination of the Essex specimens.

METEOROLOGY.

The Weather of 1900.—The following interesting summary of the weather in the United Kingdom during 1900 is re-printed from the *Standard* of January 4th, 1901 :—

"The character of the weather was exceptional in many respects during the past year, although there were but few features of striking interest. There was a remarkable freedom from spells of cold, and very little frost; whilst fog was comparatively rare. Rain was more than usually frequent, although the total measurement was not everywhere above the average, and a greater degree of warmth than usual has prevailed during the winter months. Wind storms were not at all frequent, and, with a very few exceptions, those experienced were not severe, although, towards the close of December, heavy gales occurred over the whole of the British Islands. July was the only summer month with especially high temperatures, and, although thunderstorms were fairly frequent, they were not generally heavy. The aggregate rainfall for the year was in excess of the average over the greater part of the Kingdom, the greatest excess being about 8in. in the west of Scotland and in the south of Ireland. In the western districts of England the excess amounted to 3in., but in the Midland districts the total rainfall was in agreement with the average, while in the east and south of England there was a deficiency of about 2in. The number of days with rain ranged from 255 in the north of Scotland to about 180 in the Midland Counties and in the south of England. The temperature was nearly everywhere in excess of the average. There was rather a larger amount of bright sunshine than usual, the excess on the average being more than 100 hours in the south of England and in the Channel Islands.

"In the neighbourhood of London, as shown by the observations made at Greenwich, the total rainfall for the year was about 2in. less than the average of the previous 60 years. The total measurement was 22·3in., and during the last 18 years there have only been three years with an excess of rain. The wettest month of the year was February, with a total fall of 3·61in., which is 2·12in. above the average. The only other wet months were January, with an excess of 0·40in.; June, with an excess of 0·78in.; and December, with an excess of about 0·6in. The driest month was September, with a total rainfall of 0·76in.; and in both March and April there was less than an inch of rain. The greatest deficiency was 1·43in. in September and 1·24 in October. In the five months July to November the deficiency amounted to 4·11in. Rain fell in 182 days, and with practically the same

rainfall as 1899 there were in 1900 about 40 more days with rain. In January rain fell on as many as 22 days, and in both November and December on 20 days. In July there were only six rainy days, and in September seven, but these was no other month with fewer than 13.

"The mean temperature for the year at Greenwich was 51deg., which is about 1deg. above the average of the last 60 years There were seven months with an excess of temperature, and in December the mean was 45·3deg., which is nearly 6deg. above the average. In July, which was by far the hottest month of the year, with a mean of 67·7deg., there was an excess of 4deg. Of the months with the mean temperature below the average, the greatest deficiency was 3deg. in March, and in no other month did the deficiency amount to 1·5deg. The coldest month of the year was February, with a mean of 38·5deg., while in March the mean was only 39·4deg. The absolutely highest temperature in the shade was 94deg. on July 16, and there were four days above 90deg. in July between the 16th and 25th. In June the shade temperature registered 89·4deg., while in August and September there is no reading as high as 83deg. The absolutely lowest temperature was 18deg. on Feb. 9, and the greatest number of frosts—eleven—occurred during that month. The greatest range of temperature in any month was 50·4deg. in April, the least 25·6deg. in December. The temperature was above the mean in the Metropolis on 210 days, and below the mean on 155 days. In December there were as many as 29 warm days, and in July and November 24 warm days, while in March there were 23 cold days."

British Rainfall, 1900.—Referring to the hope expressed in the notice of the late Mr. Symons on page 59 *ante*, we are glad to announce that the work of registering the rainfall in the United Kingdom will be carried on. The volume for 1900 has now (September, 1901,) been issued, edited by Dr. H. R. Mill and Mr. H. S. Wallis, for many years Mr. Symons' assistant. The work is published by Mr. Stanford. ED.

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